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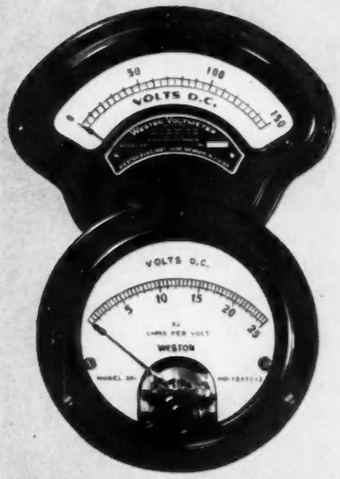

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The Story Beneath the Statistics . . .

ANNUAL reviews can be pretty dry and uninteresting unless they help to chart the path of future progress. The statistics contained in this 34th Annual Review of the electrical industry do tell a story; in fact, many stories. But the most interesting one is that which indicates future trends and problems.

The President and influential members of the New Deal have criticised the public utilities for being afraid. They have asserted that utilities have prospered under the New Deal. And obviously, then, they ask the question, Why all the wailing?

A lock on the barn door doesn't do much good after the horse has been stolen. On the surface it would appear that public utilities as a whole have not been hurt very much to date. Usage is up, and gross revenue is higher. What, then, is all the shouting about?

The load now apparently is increasing at the same rate that it did prior to the depression. At that time the utilities found it necessary to spend upward of 800 million dollars a year in new construction. And it was easy to find the money. A survey of the public utility financing for the five years 1926-1930, inclusive, showed an aggregate slightly in excess of 9½ billions, all new capital, of which 3.9 billions was in new capital stock.

And there is the nubbin of the problem. Where is this equity money coming from? In all of the financing in the last five years, little or none has come from new capital stock.

The construction expenditure figures are shown in this issue to be rising. For 1938 some 472 millions have been budgeted. While this in itself is a very substanial sum, it probably is a minimum, but is still far below predepression figures to take care of the same anticipated load growth.

Some 300 millions can come from the normal turnover of retirement and depreciation reserves and undistributed earnings. The rest must be borrowed. When capital expenditure requirements are such that the companies need to seek less than 200 millions outside, the effect on the funded debt is not large. However, if the construction program were a billion, and it could easily be that, where would the extra 700 millions come from? It probably could without much difficulty be taken up in bonds, but the industry has seen in the railroads what happens to utilities that permit a capital structure to become topheavy with bonds. Inevitably under such procedure the equity owners lose all or most of their holdings.

The utilities would issue more new capital stock if they could, but there is no market today. Why? The statistical side of the story is told in this issue. Expenses are going up faster than income, taxes mounting, wages higher, rates lower. In other words, statistically, the investor sees diminishing returns. But even that he might be willing to accept if his investments were not further jeopardized by the threat of government competition and unfair government subsidies to municipalities.

The statistics show that the utilities are striving in every way possible to meet the demands for service, but unless they will sacrifice the interest of the equity owners they will not be able to contribute their full share to business recovery until those who might be able to buy utility stocks have some assurance of stability of ownership.

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Highlights

FOR a quick résumé of the accomplishments of the electrical industry in 1937, these highlights have been prepared. They show growth in volume and growth in income. The recession late in the year did not materially affect the total year's operations. Additions to system are keeping pace with requirements. Capital expenditures are up. The picture is good.

Output: 114,200,000,000 kw.-hr.

System output up 9 per cent. Hydro still full third of total. Power imports larger.

Capacity: 35,042,000 kw.

Net increase 2.3 per cent but year's additions more efficient. Facilities being worked more hours.

New Capacity: 1,119,000 kw.

Fifty per cent more than previous year's additions. 1938 twice 1937 new capacity. Mostly additions to existing stations.

Energy Sales: 99,300,000,000 kw.-hr.

Farm usage up 24 per cent; commercial 18 per cent; residential 13 per cent and industrial 8 per cent.

Revenue: $2,376,000,000

Customers paid 7.6 per cent more than 1936 for 10.3 per cent more kilowatt-hours. One-third is residential revenue. Residential bill averages $34.83 for new high usage of 797 kw.-hr. and new low rate of 4.37 cents.

Customers: 27,000,000

More than three-quarters of a million new customers. Small gain in commercial, retail and wholesale.

Farm: 1,200,000 customers

New farm customers 160,000. Utilities now serve 27.7 per cent of all farms with dwellings in excess of $500. Rural mileage increased 40 thousand, or 25 per cent. Less to be constructed in 1938.

Expenses: $1,028,000,000

Up 10 per cent, against 8 per cent increase in revenue. Operating ratio rising. Wages higher. Allocation for maintenance up 5 millions to 120 millions in 1938.

Taxes: $307,000,000

Every seventh dollar to tax collector—50 per cent higher in five years. Equals 79 per cent of wages and salaries. Average domestic consumer pays $5.12 in taxes.

Budgets: $472,640,000

Up 4 per cent over 1937 capital expenditures. Large gains for steam station construction. Transmission and distribution down. All sections larger but South.

Manufacturers' Sales: $1,400,000,000

Production up 22½ per cent, bookings 23 per cent. Heavy equipment shows large gains. Employment increased faster than production.

OUTPUT

Ultimate Consumers Use 10 per Cent More
System Outputs Rose 9 per Cent
Hydro Still a Full Third of Total

DEPRESSION and recession do not halt the procession of kilowatt-hours. That the gyrations of business temper have relatively little effect on the over-all load imposed on the electric power systems of the country is shown again forcefully by the 1937 output figures. Actual ultimate consumption for the year (99,300,000,000 kw.-hr.) was the same old 10 per cent increase over the previous year (90,044,000,000) that constituted the 1919-1929 trend. The 2½ multiplier of that glorious decade resulted, in other words, from the same successive average annual growth factor as ruled in 1937.

Total energy generated in the utility (private and municipal) plants for the year was, however, only 7.1 per cent more than in 1936. There were two major reasons why the increase in generation was not as great as the increase in consumption. First, there was the enhanced disposition to generate nearer to load centers, with a consequent decrease in line and equipment losses from reduced amount of long-haul transmission, and there was also a closer control of the short-haul interchanges. As a result the losses between plants and users was only 1.4 per cent more than in 1936, even though 10 per cent more kilowatt-hours were delivered to users. Second, there was more power imported from industrial, federal and other foreign sources.

A big jump (54 per cent) took place in the amount of energy derived from Canada, from federal government plants (Boulder, Muscle Shoals, etc.) and from miscellaneous industrial generating plants. This importation, while greatly enhanced, is, however, only a little over 4 per cent of the total distributed by the industry. Most of the 1,700,000,000 kw.-hr. increase in "imported" energy was attributable to the generation at Boulder Dam.

A relatively good year for water enabled the increase from that source to be about 9.2 per cent. Steam output was increased practically the same amount. Hydro contributed 35.3 per cent of the total generation on utility systems and fuel plants 64.7 per cent. Over the preceding twelve-year period the total contributions from hydro and steam power were in the proportions, respectively, of 36.3 and 63.7 per cent, so it is evident that any attainment of the popular dream of an unbounded "white coal" paradise is not being reflected in generated output figures.

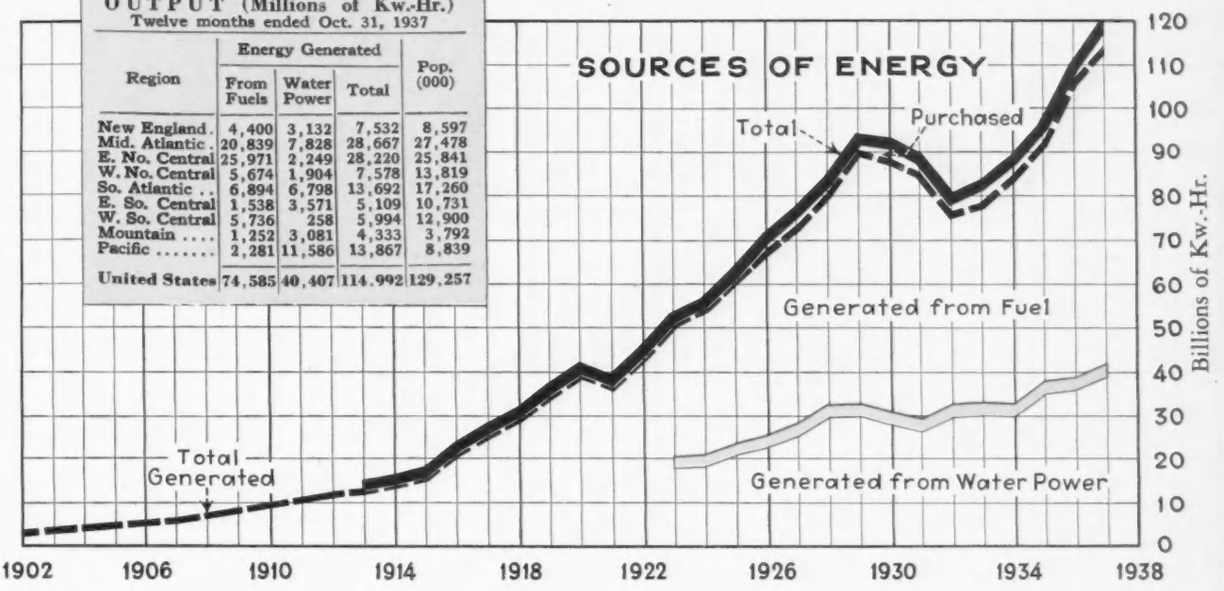
Pacific and Mountain States have abundant water power and likewise show the highest utilization per inhabitant. Middle Atlantic and East North Central areas of industrial concentration follow next, and then come those on the Atlantic seaboard. The central states, except those adjoining the Great Lakes, show the lowest generation and use per capita.

Reverting to national totals, there is only one element of generation and delivery of energy that shows a consistent trend toward decrease. That is company use. This is progressively lower in percentage value even when deducting the amounts delivered to electric railway operating departments of power companies. In 1937 only 1.8 per cent of the energy handled was used by the companies in their own operations for lighting and incidental power.

OUTPUT (Millions of Kw.-Hr.)

Twelve months ended Oct. 31, 1937

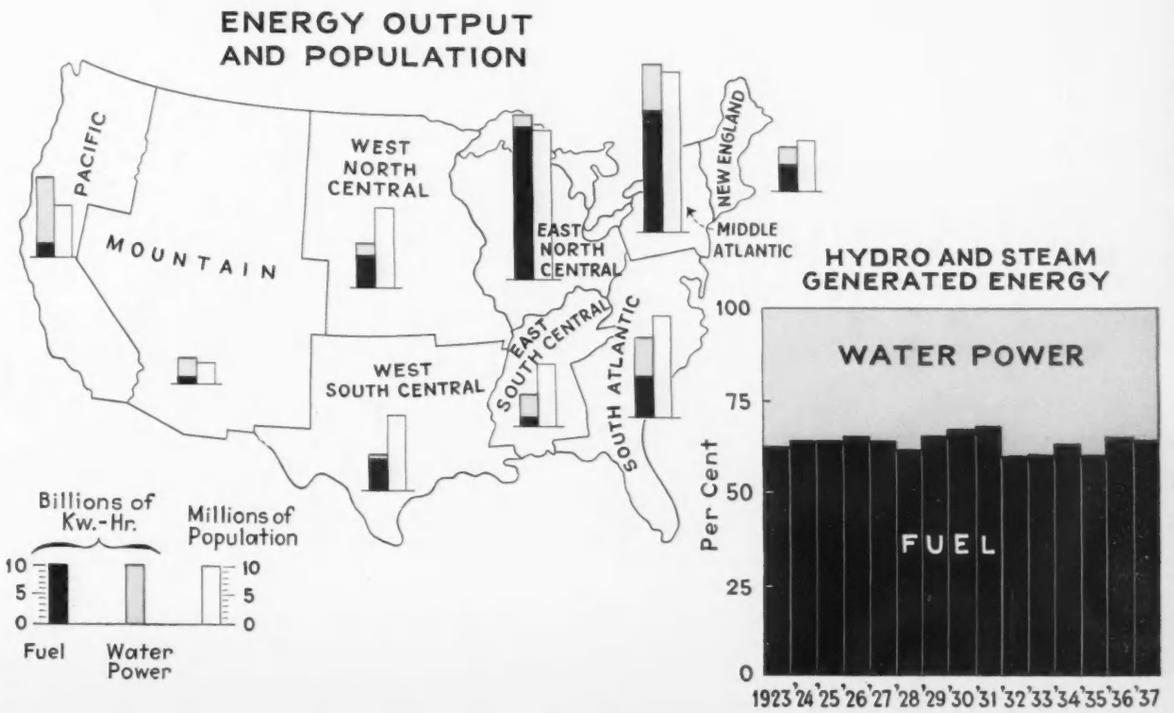
Region	Energy Generated			Pop. (000)
	From Fuels	Water Power	Total	
New England	4,400	3,132	7,532	8,597
Mid. Atlantic	20,839	7,828	28,667	27,478
E. No. Central	25,971	2,249	28,220	25,841
W. No. Central	5,674	1,904	7,578	13,819
So. Atlantic	6,894	6,798	13,692	17,260
E. So. Central	1,538	3,571	5,109	10,731
W. So. Central	5,736	258	5,994	12,900
Mountain	1,252	3,081	4,333	3,792
Pacific	2,281	11,586	13,867	8,839
United States	74,585	40,407	114,992	129,257



SOURCE AND DISPOSAL OF ENERGY (Millions of Kw.-Hr.)

Year	Generated by			Total Generated	Net Purchased	Total Net Input	Total Company Use	Losses and Energy not Accounted for	Sales to Ultimate Consumers
	Steam	Water Power	Internal Combustion						
1926	44,145.9	23,843.8	(b)	67,989.7	2,486.3	70,476.0	2,552.5	11,834.2	56,089.3
1927	46,862.5	26,381.9	(b)	73,244.4	3,124.7	76,369.1	2,458.6	12,659.3	61,251.2
1928	49,446.5	31,006.9	(b)	80,453.4	2,940.7	83,394.1	2,564.3	13,841.8	66,988.0
1929	59,128.1	30,956.3	(b)	90,084.4	2,672.7	92,757 1	2,480.0	14,982.6	75,294.5
1930	59,387.0	29,204.7	(b)	88,591.7	3,365.1	91,956.8	2,489.7	14,561.0	74,906.1
1931	58,037.7	27,537.6	(b)	85,575.3	2,825.2	88,400.5	2,336.5	14,162.1	71,901.9
1932	45,204.5	30,800.7	708.9	76,714.1	2,978.2	79,692.3	2,117.9	13,863.6	63,710.8
1933	46,871.1	31,356.5	705.4	78,933.0	3,478.0	82,411.0	1,972.5	14,522.8	65,915.7
1934	53,106.3	31,069.1	810.4	84,985.8	3,367.3	88,353.1	2,153.1	15,118.4	71,081.6
1935	55,197.4	36,543.6	870.4	92,611.4	3,252.4	95,863.8	2,168.3	16,099.5	77,596.0
1936	68,423.0	37,230.6	912.7	106,566.3	3,119.0	109,685.3	2,276.2	17,364.8	90,044.3
1937[a]	73,900.0	40,300.0	(b)	114,200.0	4,800.0[c]	119,000.0	2,100.0	17,600.0	99,300.0

(a) Ten months actual, two months estimated. (b) Included with steam generation.
(c) Large part of increase due to energy received from Boulder Dam.



CAPACITY

Net Increase of 2.3 per Cent
Additions More Efficient and Reliable
Facilities Being Worked More Hours per Year

NET result of all the spurt in adding new capacity to the generating plants of the country's electric light and power systems is a gain of 2.3 per cent for the year 1937. Many a new turbine that went in occupied the space formerly occupied by others that had served their period of efficiency and usefulness. So far it appears therefore that what has been going on has been a modernizing process, an acquisition of the more reliable and efficient prime movers, boilers, accessories and generators and a writing off of obsolete equipment.

At first glance these figures would seem to support the fear in some quarters that a power shortage exists or is imminent. But that assumption is founded solely on bare figures and takes no account of the technical and operative facts. It ignores the advances in power generation technology and in protective equipment which enhance the reliability of sources and of delivery systems.

Kilowatts freshly added at stations in the last two or three years are more capable of carrying sustained loads and even overloads than the semi-antiquated equipments they have replaced, kilowatt for kilowatt of nameplate rating. They are backed up too by more automatic safeguards from coal crusher or stoker clear through to the bus, which is the getaway point for the energy.

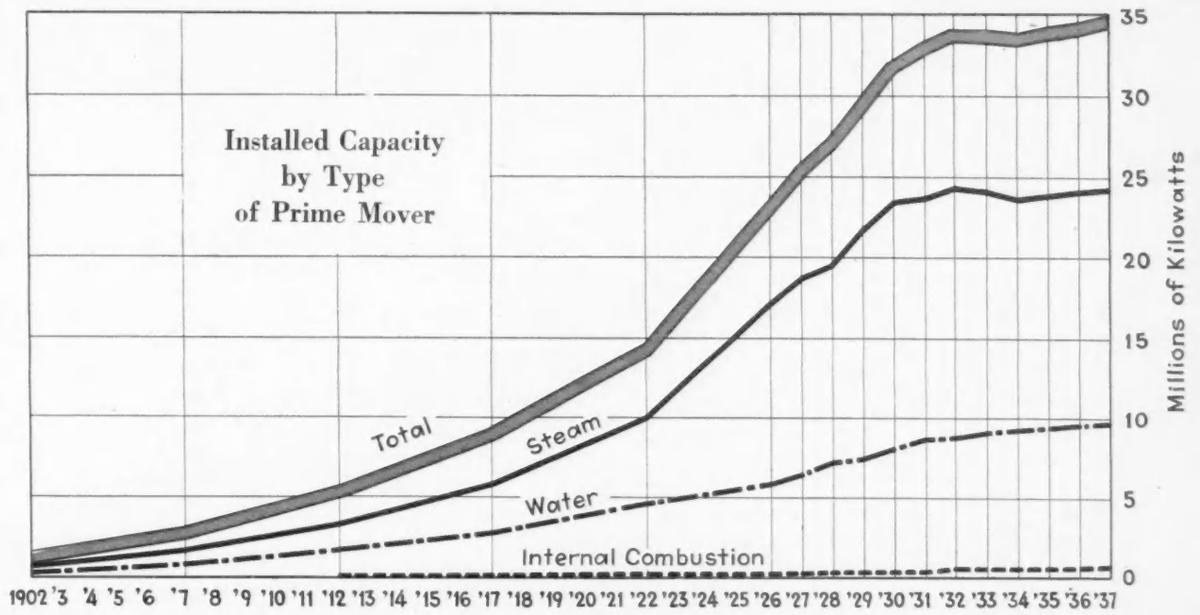
But the output went up 7 per cent in 1937, and if it rises a comparable amount in 1938, as is expected, this ability of modernized station and system set-ups to handle more kilowatt-hours per year and also meet their rising peaks will have had still more of its potentialities absorbed. One glance at the curve opposite is enough to show a marking-time disposition of the industry taken as a whole.

The generators in 1929 worked on the average 3,184 hours to grind out the needed kilowatt-hours. In 1937 a capacity 18 per cent greater turned out 26.5 per cent more kilowatt-hours, operating on the average 3,296 hours to do so. It is evident that the wave of new capacity installation has just started because so far it has been devoted largely to replacements.

One disturbing note must be recorded in a discussion of the competency of capacity. Several large cities have experienced rather extensive power outages that tend to weaken confidence in the asserted reliability of power sources. Ordinarily these disturbances are limited to the boundaries of the stations because the other interconnected sources pick up the burden. But bottlenecks in system set-ups are being disclosed by this small epidemic of outages. Their elimination, by making capacity more capable, would be comparable in effectiveness to the clear addition of new capacity. Opportunities of this sort now being actively corrected out on the systems are the real refutation of a "power shortage."

Viewing the map, it is evident that all sections of the country have added both steam and hydro power during the 1929-1937 period. For the country as a whole a net of 14 per cent has been added in that period to steam generating capacity and twice that percentage increase to hydro, until hydro capacity now represents 27.4 per cent of the total. Steam constitutes 70.7 per cent and internal combustion

ELECTRICAL WORLD'S
34th STATISTICAL ISSUE

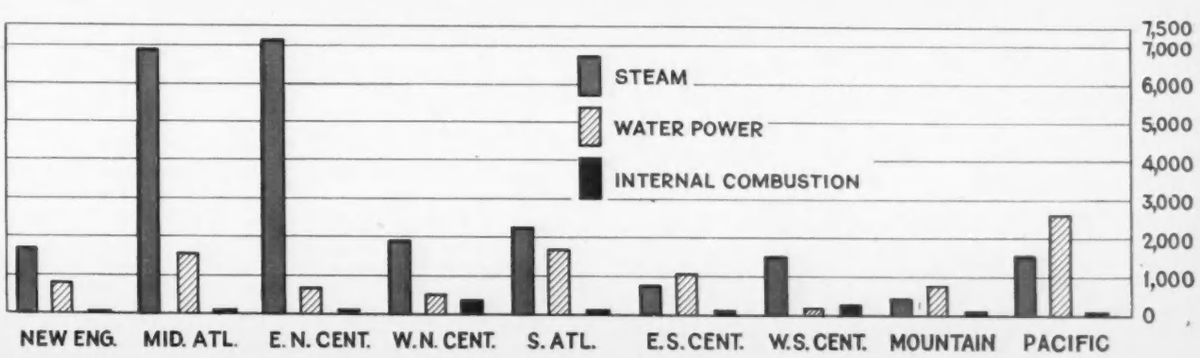


GENERATOR RATING by Regions and by Type of Prime Mover

Thousands of Kilowatts

Region	1929				1932				1934			
	Steam	Water Power	C	Total	Steam	Water Power	Int. Comb.	Total	Steam	Water Power	Int. Comb.	Total
United States.	21,744	7,438	376	29,558	24,215	8,919	459	33,593	23,788	8,952	502	33,242
New England...	1,724	582	6	2,312	1,835	818	6	2,659	1,761	812	9	2,582
Mid. Atlantic...	5,747	1,141	20	6,908	6,667	1,405	28	8,100	6,806	1,447	34	8,287
E. No. Central..	6,878	537	23	7,438	7,447	627	27	8,101	7,067	600	34	7,701
W. No. Central.	1,663	302	111	2,076	1,936	453	155	2,544	1,933	455	169	2,557
So. Atlantic....	2,184	1,299	37	3,520	2,285	1,713	47	4,045	2,270	1,678	50	3,998
E. So. Central..	691	634	25	1,350	741	639	24	1,404	662	639	25	1,326
W. So. Central..	1,289	19	114	1,422	1,487	88	119	1,694	1,500	100	123	1,723
Mountain.....	279	732	32	1,043	312	743	44	1,099	331	737	46	1,114
Pacific.....	1,289	2,192	8	3,489	1,505	2,433	9	3,947	1,458	2,484	12	3,954

	1935				1936				1937			
United States.	23,921	9,219	608	33,749	24,107	9,539	614	34,260	24,745	9,617	680	35,042
New England...	1,759	800	9	2,568	1,768	808	10	2,586	1,801	836	12	2,649
Mid. Atlantic...	6,916	1,501	27	8,444	6,963	1,516	29	8,508	6,929	1,469	33	8,431
E. No. Central..	7,116	609	50	7,775	7,187	623	43	7,853	7,419	626	51	8,096
W. No. Central.	1,892	470	203	2,565	1,976	462	212	2,650	2,154	463	228	2,845
So. Atlantic....	2,238	1,677	60	3,975	2,270	1,702	56	4,028	2,405	1,704	66	4,175
E. So. Central..	720	844	27	1,591	710	1,004	27	1,741	730	1,019	29	1,778
W. So. Central..	1,484	100	143	1,727	1,453	101	147	1,701	1,465	101	154	1,720
Mountain.....	327	744	55	1,126	345	765	51	1,161	376	780	61	1,217
Pacific.....	1,469	2,474	34	3,977	1,435	2,558	39	4,032	1,466	2,619	46	4,131



GENERATOR RATING — Public Utility Power Plants

Central stations, municipal, railway and other

Preliminary November 1, 1937, subject to revision. Courtesy of Federal Power Commission

Division and State	†Companies	*Plants	Total Capacity, Kw.	Generator Capacity of Plants Operated By										
				One Type of Prime Mover						Combination of Two or More Types				
				Water Power		Steam Power		Internal Comb. Engines		Total		Water Power	Steam Power	Int. Comb. Engines
				No.	Cap.	No.	Cap.	No.	Cap.	No.	Cap.	Cap.	Cap.	Cap.
United States	1,649	3,814	36,823,267	1,365	10,251,234	1,211	25,213,131	990	566,883	248	792,019	228,030	458,705	105,284
New England	133	323	2,913,698	222	821,466	66	1,960,235	10	9,641	25	122,356	21,997	98,115	2,244
Maine	25	75	233,608	60	175,236	7	54,775	4	935	4	2,662	1,260	800	602
New Hampshire	13	55	300,632	44	240,743	4	35,585	1	780	6	23,524	3,592	19,450	482
Vermont	23	70	176,447	60	161,937	4	9,900	....	.....	6	4,610	1,800	2,610	200
Massachusetts	51	78	1,326,085	34	153,200	35	1,098,785	3	6,480	6	67,620	12,145	54,515	960
Rhode Island	4	8	243,171	3	1,750	4	241,200	1	221	....	.....	.....	.....	.....
Connecticut	17	37	633,755	21	88,600	12	519,990	1	1,225	3	23,940	3,200	20,740	.....
Middle Atlantic	128	389	9,216,424	199	1,380,514	145	7,644,738	20	27,346	25	163,826	123,725	34,455	5,646
New York	63	238	5,262,103	165	1,098,501	55	4,135,478	5	16,545	13	11,579	4,910	2,080	4,589
New Jersey	14	25	1,071,457	3	920	15	1,059,105	4	2,717	3	8,715	5,100	3,500	115
Pennsylvania	51	126	2,882,864	31	281,093	75	2,450,155	11	8,084	9	143,532	113,715	28,875	942
E. No. Central	313	650	8,082,337	269	623,508	283	7,259,379	57	35,398	41	164,052	16,943	132,583	14,526
Ohio	69	108	2,168,699	9	12,400	85	2,145,883	13	7,816	1	2,600	600	2,000	.....
Indiana	58	98	1,026,239	20	31,300	64	980,630	11	6,927	3	7,382	3,380	3,260	742
Illinois	62	95	2,278,384	11	47,200	64	2,125,289	13	6,586	7	99,309	3,918	90,695	4,696
Michigan	62	181	1,692,983	122	297,774	37	1,373,864	11	7,875	11	13,470	2,935	4,580	5,955
Wisconsin	62	168	916,032	107	234,834	33	633,713	9	6,194	19	41,291	6,110	32,048	3,133
W. No. Central	423	786	2,811,443	114	476,880	239	2,022,043	375	201,373	58	111,147	12,305	69,850	28,992
Minnesota	67	133	619,172	41	154,486	51	443,253	30	12,494	11	8,939	2,188	3,076	3,675
Iowa	85	166	622,398	27	150,485	61	373,282	63	35,796	15	62,835	4,240	50,999	7,596
Missouri	64	108	741,786	7	150,545	35	548,059	64	41,022	2	2,160	.....	1,095	1,065
North Dakota	16	37	69,761	....	.....	17	63,179	20	6,582	....	.....	.....	.....	.....
South Dakota	31	57	71,540	6	4,262	9	40,947	39	22,212	3	4,119	.....	890	3,229
Nebraska	81	153	269,525	25	9,887	34	212,507	75	29,381	19	17,750	3,910	4,708	9,132
Kansas	79	132	417,261	8	7,215	32	340,816	84	53,886	8	15,344	1,967	9,082	4,295
So. Atlantic	159	416	4,384,117	151	1,922,437	132	2,276,507	98	53,482	29	131,691	38,702	82,834	10,155
Delaware	6	7	33,695	....	.....	4	31,200	3	2,495	....	.....	.....	.....	.....
Maryland	11	26	593,568	3	271,385	10	314,432	11	4,861	2	2,890	.....	770	2,120
Dist. of Columbia	2	3	222,400	1	2,400	2	220,000	....	.....	....	.....	.....	.....	.....
Virginia	28	69	482,857	34	80,924	17	313,290	11	5,866	7	82,777	15,006	67,400	371
W. Virginia	16	38	593,856	9	90,820	18	498,110	8	4,419	3	507	85	147	275
North Carolina	30	81	982,237	51	650,861	20	324,475	5	3,851	5	3,050	1,011	430	1,609
South Carolina	15	39	632,880	23	488,240	9	125,492	5	1,558	2	17,590	12,300	5,200	90
Georgia	18	60	474,064	27	323,627	23	132,726	6	1,564	4	16,147	10,100	5,262	785
Florida	33	87	368,560	3	14,180	29	316,782	49	28,868	6	8,730	200	3,625	4,905
E. So. Central	84	207	1,843,319	34	1,093,490	91	720,978	72	25,255	10	3,596	315	1,697	1,584
Kentucky	20	39	332,114	3	104,860	24	223,082	7	2,402	5	1,770	315	775	680
Tennessee	26	63	528,936	19	318,900	30	206,233	12	3,333	2	470	.....	350	120
Alabama	13	39	917,305	12	669,730	16	243,100	11	4,475	....	.....	.....	.....	.....
Mississippi	25	66	64,964	.....	.....	21	48,563	42	15,045	3	1,356	.....	572	784
W. So. Central	173	417	1,770,668	23	99,970	120	1,495,968	258	134,192	16	40,538	1,369	26,471	12,698
Arkansas	24	58	156,473	5	66,705	26	78,399	25	10,364	2	1,005	.....	410	595
Louisiana	36	61	314,334	.....	.....	12	291,365	47	21,044	2	1,925	.....	937	988
Oklahoma	56	105	335,511	2	1,200	31	293,941	68	37,314	4	3,056	419	672	1,965
Texas	57	193	964,350	16	32,065	51	832,263	118	65,470	8	34,552	950	24,452	9,150
Mountain	153	344	1,646,344	151	1,145,974	79	416,104	82	40,307	32	43,959	7,658	11,230	25,071
Montana	11	31	277,122	17	265,910	5	6,835	6	1,745	3	2,632	180	1,476	976
Idaho	17	47	249,312	39	244,780	3	750	3	1,612	2	2,170	1,600	.....	570
Wyoming	23	39	48,812	7	14,620	17	28,717	11	3,561	4	1,914	1,250	372	292
Colorado	33	72	251,997	21	63,015	32	179,750	14	6,913	5	2,319	1,344	200	775
New Mexico	18	39	94,902	1	80	12	77,652	23	13,727	3	3,443	788	1,430	1,225
Arizona	21	44	226,490	12	129,550	8	62,650	18	8,998	6	25,292	.....	7,152	18,140
Utah	22	59	155,947	46	89,324	2	59,750	4	2,116	7	4,757	2,100	.....	2,657
Nevada	8	13	341,762	8	338,695	.....	.....	3	1,635	2	1,432	396	600	436
Pacific	83	288	4,154,917	202	2,686,995	56	1,417,179	18	39,889	12	10,854	5,016	1,470	4,368
Washington	29	68	1,015,212	45	794,379	13	215,722	4	1,122	6	3,989	2,136	970	883
Oregon	25	67	371,084	41	189,036	17	175,010	5	1,938	4	5,100	2,030	500	2,570
California	29	153	2,768,621	116	1,703,580	26	1,026,447	9	36,829	2	1,765	850	.....	915

* Includes all plants generating energy for public use having a monthly output of 10,000 kilowatt-hours or more.

† Only companies and municipalities that have generating plants. Excludes those purchasing all of their energy. This figure includes 97 duplications because of companies operating in more than one state.

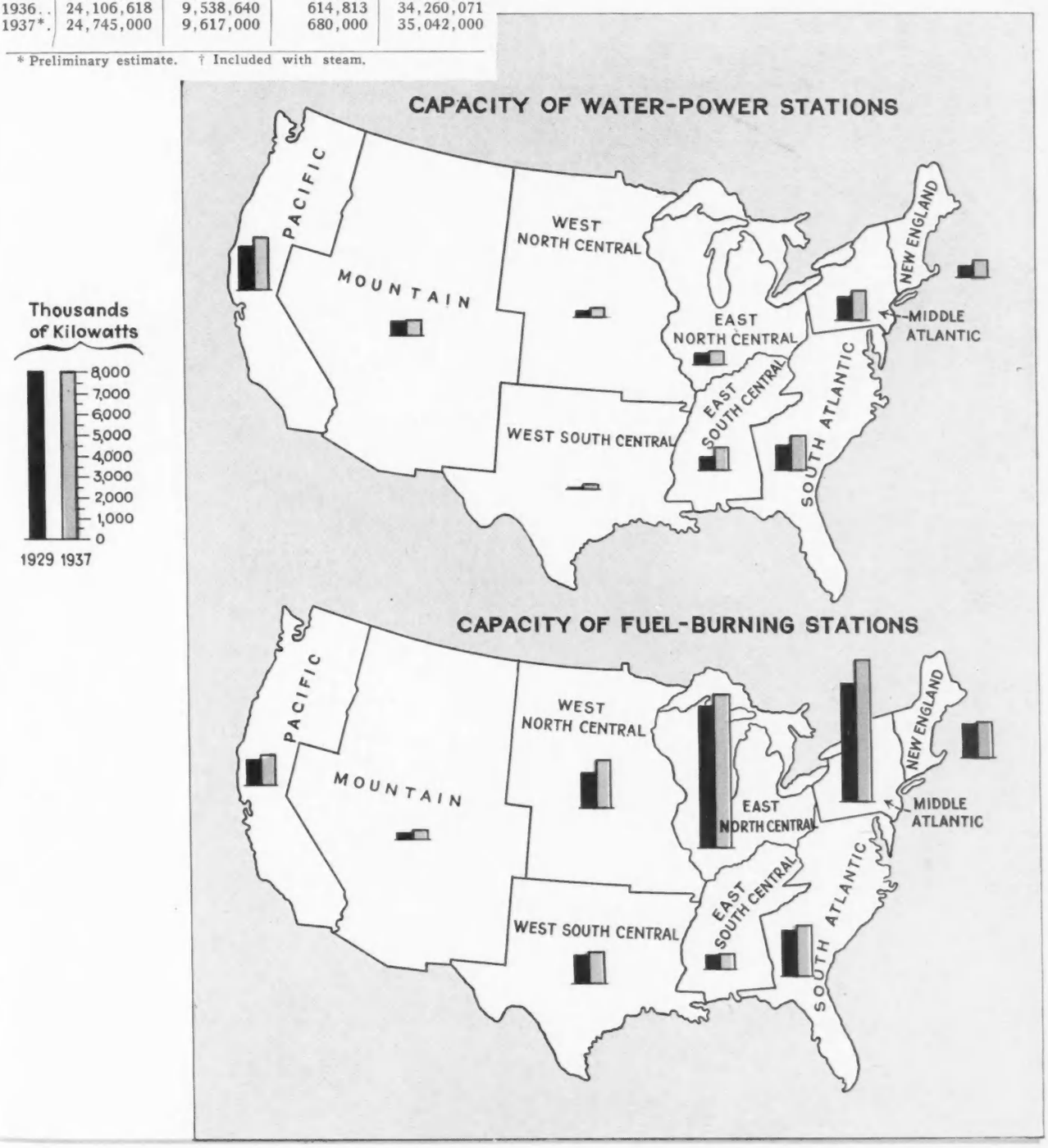
GENERATING FACILITIES
by Type of Prime Mover (Kw.)
Electric Light and Power Industry

Year	Steam	Water Power	Internal Combustion	Total
1926..	17,081,712	6,095,556	†	23,126,268
1927..	18,723,783	6,554,321	†	25,278,104
1928..	19,645,799	7,278,989	295,875	27,220,663
1929..	21,743,602	7,438,882	376,153	29,558,637
1930..	23,427,058	8,206,732	416,129	31,889,919
1931..	23,823,017	8,806,096	447,793	33,076,906
1932..	24,358,777	8,922,969	582,326	33,864,072
1933..	24,165,698	8,974,887	593,035	33,733,620
1934..	23,780,148	9,140,690	603,633	33,524,471
1935..	23,989,227	9,288,537	610,541	33,888,305
1936..	24,106,618	9,538,640	614,813	34,260,071
1937*.	24,745,000	9,617,000	680,000	35,042,000

* Preliminary estimate. † Included with steam.

the remaining 1.9 per cent of the entire installed capacity.

For the country as a whole the average size of the 1,365 hydro stations is about 7,500 kw. On the other hand, the 1,211 steam plants average almost 21,000 kw. Diesel and other oil and gas fuel plants average less than 600 kw. each. The trend away from very large units in very large stations is being offset somewhat by the tendency to replace small obsolete units in existing stations with substantially larger units occupying less space for themselves and their auxiliaries, due to higher operating speeds, higher steam pressures and temperatures.



NEW CAPACITY

Added Kilowatts to Double in 1938
New Transmission to Be Somewhat Under 1937
Substation Additions to Total 2,400,000 Kva. Activity

GENERATING capacity added to United States power systems was 55 per cent greater during 1937 than in 1936. Even more encouraging is the fact that for 1938 there is scheduled a block of new power plant capacity which will exceed the efforts of 1937 by a second increase of 60 per cent. Adding further the capacity to go into federal projects results in a doubling of the 1937 increment.

Actual net increase by private and municipal enterprises during the past year was, however, only about 2 per cent, because almost a third of the total was used to supersede obsolete equipment in the process of adding modern, efficient and reliable generating equipment.

Former annual surveys labeled this contribution "new generating stations." That title would be a misnomer for the activities of 1937. The past year has seen 3½ times as much capacity added to existing stations as was installed in wholly new plants.

Private and municipal enterprises are bringing their generating facilities up to modern conceptions of economy and reliability by taking advantage of higher steam pressures and temperatures, higher rotational speeds and hydrogen cooling. Medium sized machines have been installed in space from which far smaller capacity machines have been removed because they had outlived their usefulness. Projects for 1938 show a further continuation of this intention with capacity in new plants being outrated by that to go into the existing plants in the ratio of 4½ to one.

Received too late to incorporate in the tabulated data are the federal figures for new capacity. TVA will add 198,000 hp. this year, the Reclamation Service will add 230,000 hp. and the projects under the Corps of Engineers will add 86,000 kw. These boost the nation-wide totals to approximately 2,300,000 kw., resulting in a doubling of the kilowatt increments made in 1937.

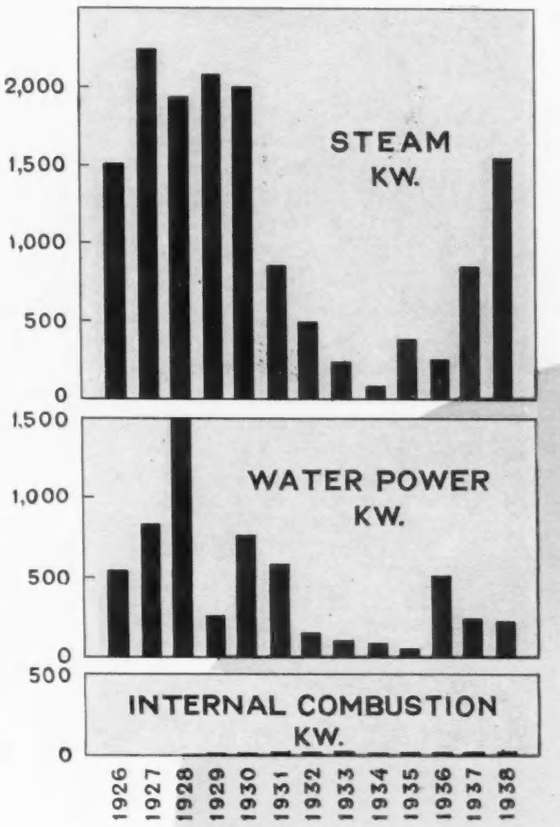
Private utilities installed twenty times as much new steam-generated capacity in 1937 as they did hydro. The present year will, however, see a spurt in hydro generating activities on the part of private utilities. They project 202,335 kw., which is five times as much as in the year just past. The steam commitments will nearly double, and this will mean that they will still be 6½ times as active on the steam side as on the hydro.

Internal combustion prime movers constituted 2 per cent of the total new generating capacity and the projected totals for 1938 are approximately in step with other growth.

In new transmission line mileage the year 1937 outdid 1936 by nearly tripling, but reported prospects for 1938 show a moderate decrease. The estimated total will be about 4,600 miles.

New substation kva. capacity in 1937 also almost tripled the accomplishment of the preceding year, with prospects for 1938 somewhat smaller, the total being near 2,400,000 kva. Central, southern and mountain states promise practically all the boost in activity, the two seaboards being minded only to repeat about the same additions as in 1937.

NEW GENERATING CAPACITY



NEW GENERATING CAPACITY ADDED EACH YEAR

as reported to *Electrical World* for the entire industry

Year	Kilowatts			Total
	Steam	Water	Int. Comb.	
1926...	*1,514,000	†518,000	(s)	2,034,000
1927...	*2,240,000	†818,000	(s)	3,058,000
1928...	1,935,500	†1,520,000	(s)	3,455,500
1929...	2,075,285	†249,200	5,800	2,329,485
1930...	2,034,527	748,480	6,420	2,789,437
1931...	821,100	566,500	15,400	1,403,000
1932...	457,750	126,155	8,550	592,455
1933...	215,775	95,325	35,250	346,350
1934...	47,000	41,900	5,805	94,705
1935...	345,325	38,950	1,815	386,090
1936...	211,900	‡489,865	19,328	721,093
1937...	851,100	245,346	22,314	1,118,760
1938[a] ..	1,554,175	233,460	30,225	1,817,860

* Kw. estimated, based on kva. reported.
† Kw. estimated; reported wholly or partly in hp.
‡ Incl. Boulder 165,000, Norris 100,000.
s Included with steam.
[a] Scheduled for completion during year.

NEW TRANSMISSION LINES

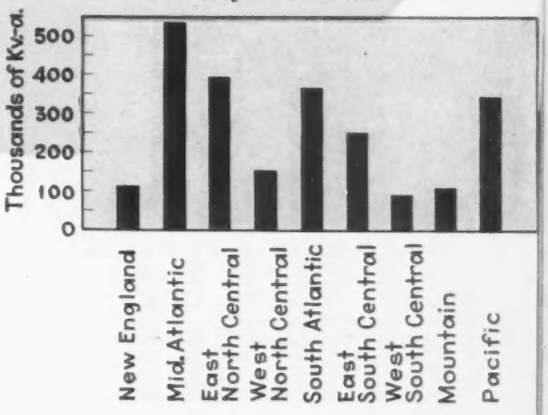
Projects for 1938

MILES OF TRANSMISSION LINES

Region	Reported			Est. Total 1938
	1936	1937	1938	
New England	65	120	86	91
Middle Atlantic	85	279	260	260
E. No. Central	192	683	461	528
W. No. Central	207	482	344	394
So. Atlantic	335	588	661	893
E. So. Central	56	266	336	541
W. So. Central	100	414	434	645
Mountain	166	581	235	303
Pacific	318	800	930	934
United States	1,524	4,213	3,747	4,589

NEW SUBSTATION CAPACITY

Projects for 1938



CONSTRUCTION OF SUBSTATIONS (Kva.)

Region	Reported			Est. Total 1938
	1936	1937	1938	
New England	88,950	137,622	106,484	112,920
Middle Atlantic	137,591	510,635	538,270	538,270
E. No. Central	193,423	519,137	342,925	393,262
W. No. Central	113,505	281,233	135,025	154,845
So. Atlantic	131,875	325,003	273,750	369,932
E. So. Central	26,690	54,616	156,125	251,814
W. So. Central	24,325	128,250	63,887	95,069
Mountain	49,300	96,237	89,216	115,266
Pacific	21,265	192,708	347,100	348,144
United States	786,924	2,245,441	2,052,782	2,379,522

GENERATING CAPACITY ADDED IN 1937

Steam

Private Companies	New Plants, Kw.	Additions, Kw.
Cumberland County P. & L.	.....	4,000
Connecticut Lt. & Pwr.	25,000	.....
West Penn Power	.....	50,000
Consolidated Ed. of N. Y.	.....	53,000
Rochester Gas & Electric	.....	13,500
Pennsylvania Electric	.....	5,000
Toledo Edison	.....	5,000
Ohio Public Service	.....	6,250
Detroit Edison	.....	60,000
Central Illinois El. & Gas	.....	2,500
Public Serv. of Indiana	.....	15,000
Chicago Dist. Elec. Gen.	.....	100,000
Wisconsin Power & Light	.....	1,000
Dayton Power & Light	.....	25,000
Commonwealth Edison	.....	90,000
American Utilities Service	.....	1,500
Consumers Power	.....	10,000
Union Elec. of Missouri	.....	75,000
Northwestern Pub. Serv.	.....	600
Nebraska Power	.....	10,000
Iowa Electric L. & P.	.....	5,000
Kansas City P. & L.	.....	20,000
Missouri Utilities	.....	3,750
Northern States Pwr. of Del.	.....	3,000
Western Pub. Serv. (Nebr.)	.....	1,500
Iowa Public Service	.....	10,250
Western L. & T. (Kansas)	.....	3,000
Potomac Edison	10,000	.....
Duke Power	.....	55,000
Tampa Electric	.....	6,000
Louisville Gas & Elec.	.....	25,000
Arkansas Power & Light	.....	12,000
Community Pub. Serv. (Tex.)	.....	2,000
Sheridan County Electric	.....	2,500
Public Serv. of Colorado	.....	5,000
Tucson Gas, E. L. & P.	.....	5,000
Utah Power & Light	.....	500
Central Arizona P. & L.	.....	12,500
Pacific Gas & Electric	.....	3,500
Portland General Elec.	.....	14,500
San Diego Con. G. & E.	.....	35,000
	35,000	752,350
Municipal Plants		
Montpelier, Ohio	.....	1,000
Galion, Ohio	.....	3,000
Jasper, Ind.	.....	2,000
Woodstock, Ill.	.....	4,000
Blissfield, Mich.	.....	500
Richland Center, Wis.	.....	1,250
Virginia, Minn.	2,500	.....
Two Harbors, Minn.	.....	1,500
Fairmont, Minn.	.....	2,500
Marshall, Mo.	1,500	.....
Coffeyville, Kan.	.....	5,000
Kansas City, Kan.	.....	30,000
Wellington, Kan.	.....	2,000
Cedar Falls, Iowa	.....	2,500
Washington, N. C.	.....	2,000
Canton, Miss.	.....	500
Austin, Texas	.....	2,000
	4,000	59,750

Water Power

Private Companies	New Plants, Kw.	Additions, Kw.
Cumberland County P. & L.	6,650	.....
Public Electric Light	3,000	.....
Public Serv. of N. Hamp.	.....	1,800
Connecticut L. & P.	.....	2,000
Twin State Gas & Elec.	.....	240
Orange & Rockland Elec.	.....	250
Wisconsin P. & L.	.....	300
Wisconsin Public Serv.	2,600	.....
American Utilities Serv.	.....	100
Virginia El. & Power	.....	1,200
Potomac Edison	.....	1,000
Idaho Power	20,100	.....
Mountain States Power	600	.....
	32,950	6,890
Municipal Plants		
Kennebunk Elec. Light	206	.....
Seattle, Wash.	[a]133,300	.....
[a] Part late 1936, 60,060 in 1937.		
Federal Construction		
Wheeler Dam, TVA	32,000	.....
Boulder Dam	.....	40,000
	165,206	40,000

Internal Combustion

Private Companies	New Plants, Kw.	Additions, Kw.
Edison Sault Elec.	.....	1,000
Iowa Public Serv.	.....	1,000
Iowa-Nebraska L. & P.	.....	1,500
Eastern Shore Pub. Serv.	1,250	489
Southern Pub. Serv. (Ky.)	.....	150
West Memphis Pwr. & Wr.	.....	360
Public Serv. of Colorado	.....	150
Utah Power & Light	.....	60
Arizona Edison	.....	600
Elko Lamoille Power	.....	*750
West Coast Power	.....	240
	1,250	6,299
Municipal Plants		
Wolfeboro, N. H.	.....	450
Hudson, Mass.	.....	1,000
Arcade, N. Y.	.....	350
Grove City, Pa.	.....	600
Goshen, Ind.	.....	1,000
Grand Haven, Mich.	.....	*2,500
Cedarburg, Wis.	*1,000	.....
Fayette, Mo.	.....	433
Girard, Kan.	.....	*700
Wahoo, Neb.	.....	1,000
Holdredge, Neb.	.....	517
Tarboro, N. C.	1,230	875
Brady, Texas	.....	800
Greenville, Tex.	.....	1,410
Bryan, Texas	.....	700
Tulsa, Okla.	.....	200
Phoenix, Ariz.	.....	600
West Coast Power	.....	240
	2,230	12,535

* Horsepower.

GENERATING CAPACITY ADDED in 1937

	Private Companies	Municipal and Federal	Total
Steam	787,350	63,750	851,100
Water power	39,840	205,506	245,346
Int. comb'n.	7,549	14,765	22,314
Total	834,739	284,021	1,118,760

GENERATING CAPACITY SCHEDULED for 1938

	Private Companies	Municipal and Federal	Total
Steam	1,350,050	204,125	1,554,175
Water power	202,335	31,125	233,460
Int. comb'n.	14,750	15,475	30,225
Total	1,567,135	250,725	1,817,860

GENERATING CAPACITY SCHEDULED FOR COMPLETION IN 1938

Steam

Private Companies	New Plants, Kw.	Additions, Kw.
Hartford Electric Light	.....	40,000
Public Serv. of New Hamp	20,000	.....
Boston Edison	.....	30,000
New York State Elec. & Gas	20,000	.....
Public Service Elec. & Gas	.....	50,000
Metropolitan Edison	.....	27,000
Duquesne Light	.....	60,000
Consolidated Ed. of N. Y	.....	123,000
Philadelphia Electric	.....	50,000
Rochester Gas & Electric	.....	25,000
Wellsboro Electric	.....	1,500
Pennsylvania Electric	.....	35,000
Cleveland Elec. Illum'g	.....	50,000
Toledo Edison	.....	5,000
Central Ohio Lt. & Power	10,000	.....
Ohio Public Service	.....	8,550
Detroit Edison	.....	90,000
Chicago Dist. Elec. Gen'g	.....	42,000
Madison Gas & Electric	.....	20,000
Indianapolis Power & Lt	.....	17,500
Columbus & So. Ohio. Elec	.....	30,000
Cincinnati Gas & Elec	.....	100,000
Consumers Power	35,000	.....
Central Illinois Light	.....	25,000
South'n Indiana Gas & Elec	.....	20,000
Ohio Edison	.....	20,000
Nebraska Power	5,000	.....
Kansas Electric Power	10,000	.....
Iowa Electric Lt. & Pwr	.....	7,500
Kansas City Pwr. & Lt	.....	15,000
Missouri Utilities	.....	1,000
Northern States Pwr., Del	.....	40,000
(Name not released)	.....	35,000
Kansas Gas & Electric	23,000	.....
(Name not released)	.....	1,500
Potomac Edison	.....	30,000
Potomac Electric Power	.....	35,000
New Orleans Public Serv	.....	30,000
Public Serv. of Oklahoma	.....	20,000
Houston Lighting & Pwr	.....	25,000
Southwestern Gas & Elec	.....	15,000
Texas-New Mexico Util	.....	7,500
Dallas Power & Light	25,000	.....
Panhandle Pwr. & Lt., new stations	7,500	.....
Montana-Dakota Utilities	.....	1,500
Public Serv. of Colorado	.....	20,000
New Mexico Public Util	.....	1,000
Pacific Gas & Elec	.....	40,000
	155,500	1,194,550
Municipal Plants		
Taunton, Mass	.....	7,500
Jamestown, N. Y	.....	15,000
Painesville, Ohio	.....	5,000
Norwalk, Ohio	.....	2,500
Martins Ferry, Ohio	.....	3,500
Cleveland, Ohio	.....	25,000
Orrville, Ohio	.....	2,500
Bluffton, Ind	.....	1,500
Springfield, Ill	.....	15,000
Blissfield, Mich	.....	1,000
Lansing, Mich	29,000	.....
Dover, Ohio	2,000	.....
Washington, Ind	.....	375
Wyandotte, Mich	.....	3,500
Crawfordsville, Ind	.....	5,000
Anderson, Ind	.....	10,000
Willmar, Minn	.....	2,000
New Ulm, Minn	.....	3,000
Owatoma, Minn	.....	2,500
Muscatine, Iowa	.....	7,500
Atlantic, Iowa	.....	1,500
Alliance, Neb	.....	2,000
Grand Island, Neb	.....	4,000
Valley City, N. D	.....	2,500
Brookings, S. D	.....	1,000
Dover, Del	.....	2,500
Thomasville, Ga	.....	3,000
Jacksonville, Fla	.....	35,000
Hagerstown, Md	.....	6,250
Dyersburg, Tenn	.....	3,000
	31,000	173,125

Water Power

Private Companies	New Plants, Kw.	Additions Kw.
Public Electric Light	.....	3,000
Central Vermont Pub. Serv	1,400	.....
Wisconsin Power & Lt	.....	1,400
Wisconsin Public Serv	17,000	.....
American Utilities Serv	.....	500
Northern States Power	.....	360
Arkansas Power & Lt	40,000	.....
Southern Utah Power	.....	125
Montana Power	56,000	.....
Washington Gas & Elec	50	.....
Southern California Ed	82,500 (leased)	.....
	196,950	5,385
Municipal Plants		
Holyoke, Mass	.....	1,000
Danville, Va	10,125	
High Point, N. C	20,000	.....
	30,125	1,000

Internal Combustion

Private Companies	New Plants Kw.	Additions Kw.
New York State El. & Gas	.....	150
American Utilities Serv	.....	200
Northwestern Public Serv	.....	1,000
Dakota Power	1,120	.....
North Dakota Pwr. & Lt	.....	1,000
Iowa Public Service	.....	1,000
Iowa-Nebraska Lt. & Pwr	2,000	.....
South Carolina Utilities	.....	1,000
West Memphis Pwr. & Lt	.....	1,000
Louisiana Pub. Utilities	.....	500
Gulf Public Service	.....	1,000
Southwestern Public Service	.....	2,500
Arizona Edison	.....	2,280
	3,120	11,630
Municipal Plants		
Marblehead, Mass	.....	700
Charlevoix, Mich	.....	800
Hillsdale, Mich	.....	*2,250
Marshall, Minn	.....	1,000
Slater, Mo	.....	750
Carthage, Mo	.....	1,500
Girard, Kan	.....	*1,250
Winterset, Iowa	.....	300
Bloomfield, Iowa	.....	100
Morgan City, La	.....	1,525
Clayton, New Mexico	.....	300
Phoenix, Ariz	5,000	.....
	5,000	10,475

* Horsepower.

STATION ECONOMICS

Record Made in National Plant Factor

Reliability Outrules Refined Efficiency

Steam Surpasses Hydro in Hours Use Gain

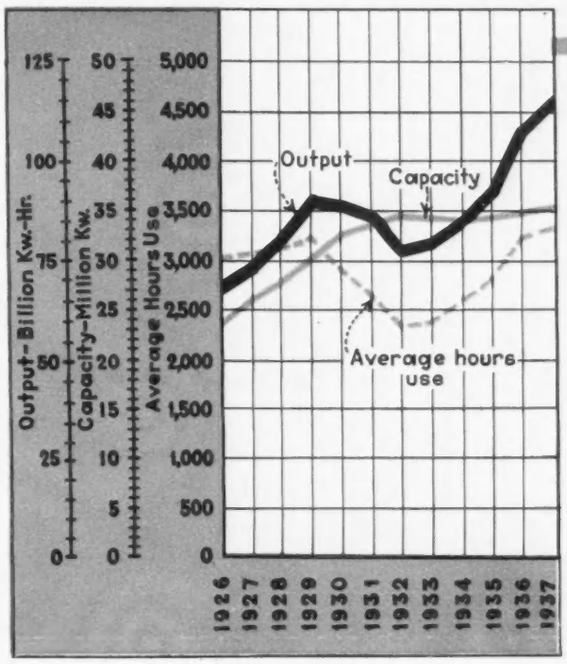
OUTPUT walked sharply away from generating capacity during 1937, so much so that each kilowatt turned out more kilowatt-hours or worked more hours on the average than at any time in the history of the industry. Actually the kilowatt-hours per kilowatt were 3 per cent higher in 1937 than in the previous high year of 1929. Whatever was gained by the addition of modern efficient units was not, therefore, enough to avert operating the total equipment to a record degree. Although output moderated late in the year, much of the new capacity was also first operated late in the year, so that the plant factors and hours average use during the first two quarters of 1937 must have been still higher than the year's average.

Reliability is more evidenced by the increased working of the equipment than is efficiency. The pounds of coal per kilowatt-hour have been tapering slowly downward toward the 1937 attained figure of 1.43. The years 1935 and 1936 showed 1.46 and 1.44 respectively. There has been a new gain made, but quite naturally it flattens out as it approaches the irreducible minimum.

Another reason for a small gain in efficiency is that there is not today the zeal for squeezing the last ounce of academic economy from fuel. When coal costs 2 mills per pound, the saving of another one-hundredth of a pound per kilowatt-hour does not perform wonders in reducing the cost of producing a kilowatt-hour if the companies have to generate 500 of them before they save one cent in fuel. Or, putting it in terms of industry expenditures for coal (some $180,000,000), it may be quite profitless to save $1,500,000 on this item if the national capital outlay to assure it may have to be $260,000,000. This astounding figure is indicated by the data in ELECTRICAL WORLD'S Steam Station Cost Survey (October 9, 1937), which showed (page 73) that 0.7 per cent gain in thermal efficiency was attained in representative plants by investing about $8 more per kilowatt of capacity.

Average hours of operation are higher than at any time since 1926. For all capacity the figure was 3,296 kw.-hr. per kilowatt this past year. The significant thing, however, is that hydro was worked 4,195 hours, and this was only 1.5 per cent under the high 1928 working figure of 4,255 hours. Fuel capacity was what provided the increase of the over-all average, because it reached the new high figure of 2,905 hours. That is 8 per cent above the previous 1929 high of 2,670 hours. Presumably hydro is being worked for all that the streams will support, so the bulk of the increased output has to be contributed by working the steam equipment more hours. Just how this is related to load factor at the plants and plant factor within the plants would be interesting to know with certainty, but an aggregate of peaks is a practically unobtainable figure and nearly meaningless because of diversity.

The power industry is just about as good a coal customer now as in 1929. It is using 50 per cent more oil and 50 per cent more gas for power fuel than it did in 1929.



OUTPUT, CAPACITY, AVERAGE USE

Electric Light and Power Industry

Year	Energy Generated (Millions of Kw.-Hr.)	Generating Capacity End of Year (Kw.)	Output per Kw. of Av'ge Cap. (Kw.-Hr.)*
1926...	67,990	23,126,268	2,985
1927...	73,244	25,278,104	3,026
1928...	80,453	27,220,663	3,065
1929...	90,084	29,558,637	3,184
1930...	88,592	32,049,919	2,876
1931...	85,575	33,076,906	2,628
1932...	76,714	33,864,072	2,292
1933...	78,933	33,733,620	2,335
1934...	84,986	33,524,471	2,527
1935...	92,611	33,888,305	2,748
1936...	106,566	34,260,071	3,127
1937†..	114,200	35,042,000	3,296

* Equivalent to average hours use of capacity.
† Preliminary.

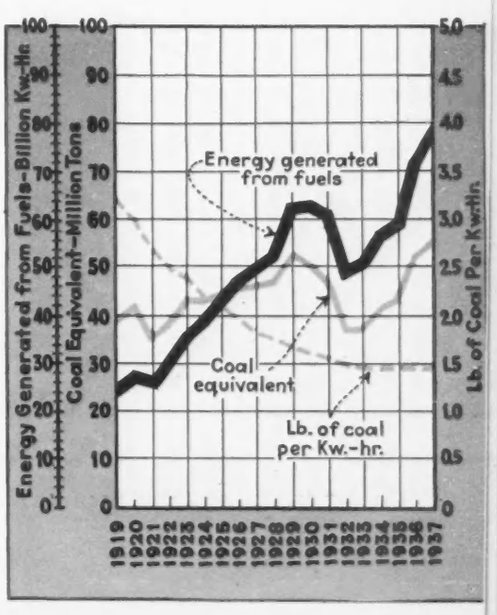
OUTPUT FROM FUEL AND FUEL CONSUMPTION

All public utility plants—Central stations, electric railway, electrified railroad, public works and other plants generating energy for public use

These statistics relate to *all* plants (not exclusively to central stations) having an output of 10,000 kw.-hr. per month, comprised in the totals reported each month, formerly by the U. S. Geological Survey, since July, 1936, by the Federal Power Commission.

Year	Energy Generated (Millions of Kw.-Hr.) from Fuel†	Fuel Consumed			Coal Plus Coal Equivalent of Oil and Gas (Millions of Tons)	Pounds of Coal per Kw.-Hr.†
		Coal (Millions of Tons)	Oil (Millions of Bbl.)	Gas (Billions of Cu. Ft.)		
1919...	24,175	35.10	11.05	21.41	38.88	3.2
1920...	27,248	37.12	13.12	24.70	41.42	3.0
1921...	25,863	31.59	12.05	23.72	35.24	2.7
1922...	30,234	34.18	13.20	27.17	38.00	2.5
1923...	36,088	38.97	14.68	31.43	43.52	2.4
1924...	38,808	37.56	16.63	48.44	43.13	2.2
1925...	43,264	40.22	10.25	46.52	44.78	2.1
1926...	47,274	41.31	9.40	53.21	45.86	1.95
1927...	49,995	41.89	6.78	62.92	45.91	1.84
1928...	52,793	41.35	7.16	77.33	46.39	1.76
1929...	62,284	44.94	10.12	112.71	52.57	1.69
1930...	62,514	42.90	9.26	120.29	50.65	1.62
1931...	60,768	38.73	8.12	139.33	47.13	1.55
1932...	48,931	30.29	7.97	107.88	36.60	1.50
1933...	50,542	30.58	9.94	102.60	37.16	1.47
1934...	56,914	33.56	10.38	127.90	41.27	1.47
1935...	59,176	34.81	11.39	125.24	43.19	1.46
1936...	72,188	42.03	14.12	156.08	51.99	1.44
1937*..	77,500	44.89	14.82	167.95	55.42	1.43

* Ten months actual, two months estimated.
† Output by use of wood not included.



ENERGY SALES

Farm Usage Up 24 per Cent
Residential Gains 13 per Cent
Commercial 18 per Cent and Industrial 8 per Cent

DURING 1937 more electric energy was used by the people of the United States in their homes, offices, stores, businesses and factories than ever before in the history of the electric utility industry.

Greatest gains were scored, in percentage, in farm usage, which was 24.4 per cent above 1936; in commercial usage, which was 17.9 per cent above 1936; in electrification of steam railroads, which was up 14.8 per cent; in residential usage, which was 12.9 per cent above 1936, and in industrial usage, up 8.2 per cent.

Largest group usage during 1937 was, as usual, the commercial large light and power classification, these customers purchasing 52,640,000,000 kw.-hr., or 53 per cent of the total sales to ultimate consumers. This use of purchased power by American industry was a new high and is all the more striking when it is viewed as exceeding the 1932 usage by 70 per cent and exceeding the pre-depression peak of 1929 by 22.5 per cent.

Such gains direct attention to the increasing preference for purchased power. At the same time they are reminders to utility management that these tremendous loads have characteristics which require watching. It is seen that again in 1937 the month-to-month variation was broad; that from year to year it still grows and subsides over a wide range, and (as shown on page 87) was sold in 1937 at an all-time low price of 1.17 cents per kilowatt-hour.

Sales to commercial small light and power customers have been gratifying during 1937. These sales were up only 6 per cent in 1934, increased 12 to 13 per cent per year in 1935 and 1936, but in 1937 made their largest growth of 18 per cent. Wholesale and retail commercial sales together increased by 10.6 per cent to 71,050,000,000 kw.-hr., or 72 per cent of total sales.

From a social angle the utility industry can view with some pride the new high total in the use of service by the urban and rural homes of the nation. Gains of 24.4 per cent in farm usage and 12.9 per cent in urban (residential) usage resulted in total sales of 19,590,000,000 kw.-hr.

In less than ten years usage has been doubled, both on the farm and in the urban home. This is one measure of the degree to which the average citizen utilizes a service now costing him one-half what it cost in 1913, although his cost of living is now almost one-half as much again as it was before the war.

In the four remaining classifications street and interurban railway usage has held the gains reached last year and exceeded them slightly. This is due to more riding and longer riding, and the use of the trolley-bus to retain electric railway loads.

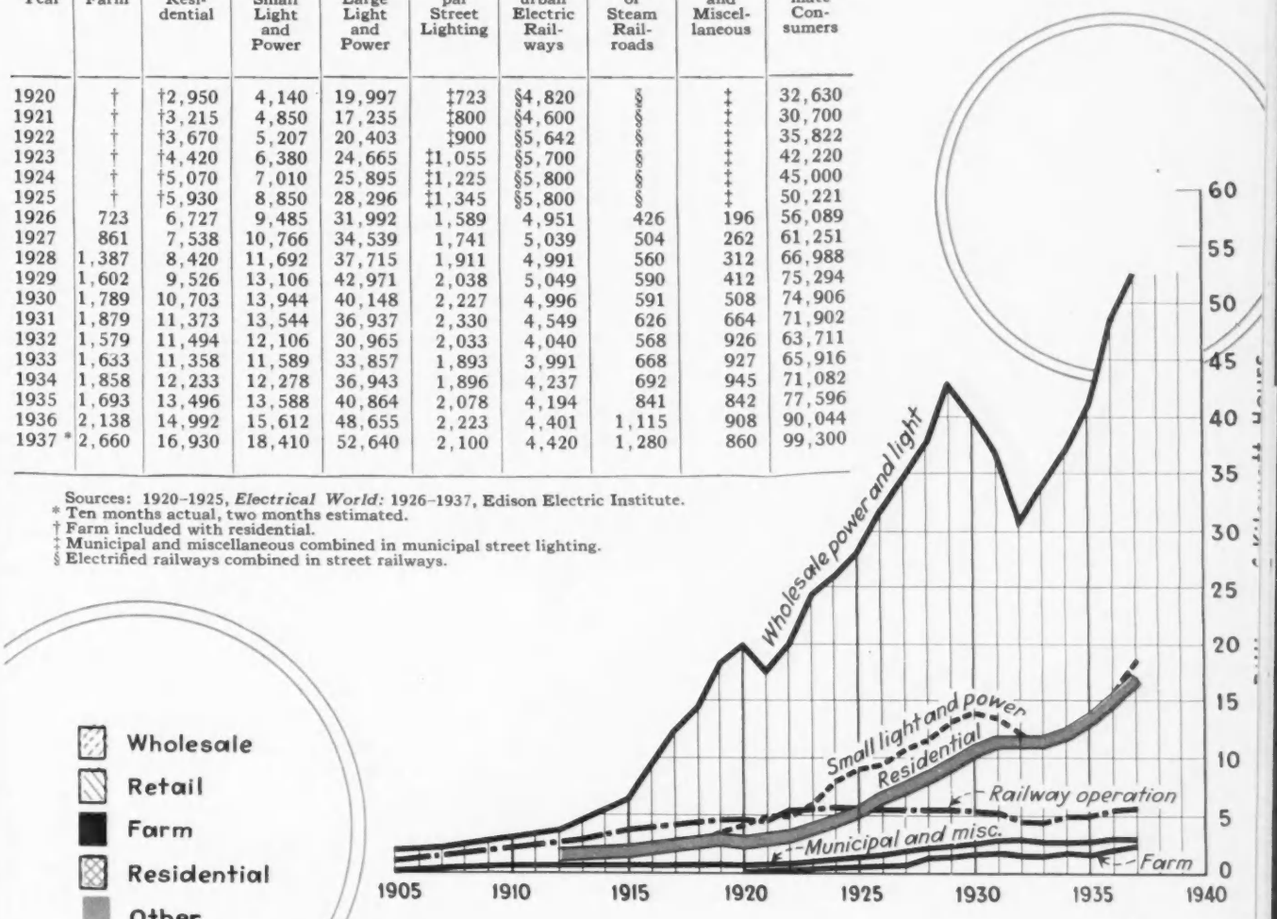
Municipal street lighting tapered off in 1937, but still ranges within 10 per cent of the usage of five to eight years ago. Apparently the diminished usage occasioned by newer lamps has, practically speaking, been offset by the addition of new street and highway lighting installations.

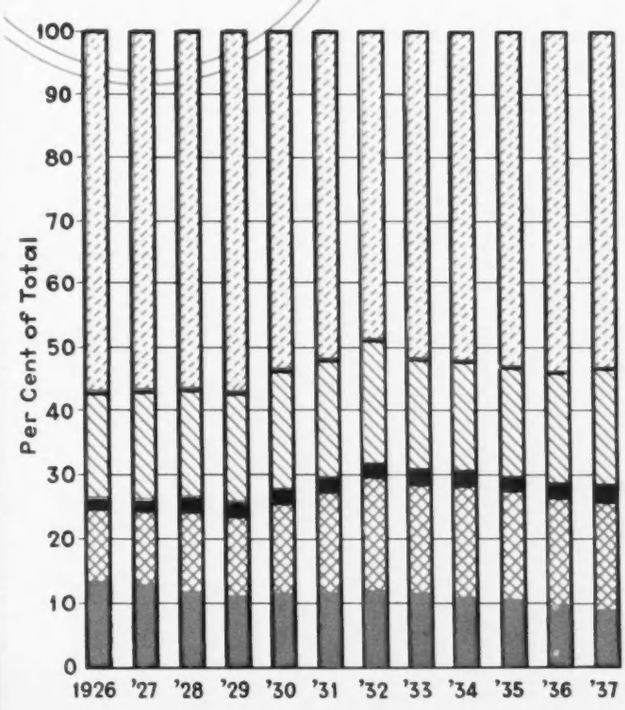
The large gains made by steam railroad electrification usage were not only held in 1937 but exceeded the 1936 usage by some 15 per cent.

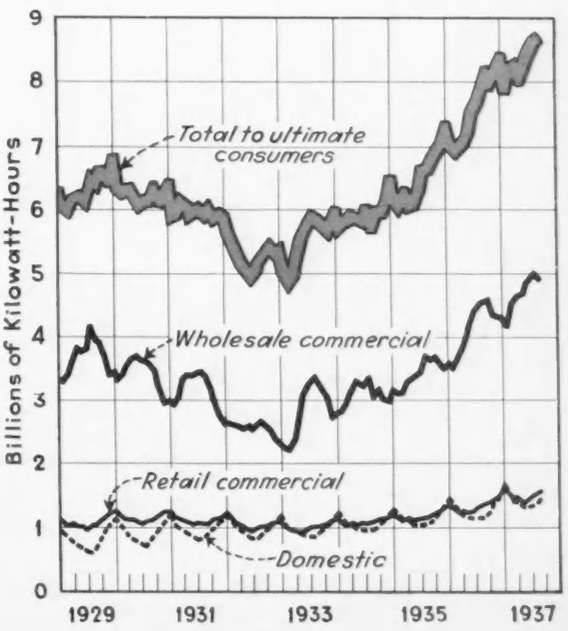
ENERGY SALES to Ultimate Consumers in Millions of Kilowatt-Hours

Year	Farm	Residential	Commercial Small Light and Power	Commercial Large Light and Power	Municipal Street Lighting	Street and Interurban Electric Railways	Electrified Divisions of Steam Railroads	Municipal and Miscellaneous	Total to Ultimate Consumers
1920	†	†2,950	4,140	19,997	‡723	§4,820	§	‡	32,630
1921	†	†3,215	4,850	17,235	‡800	§4,600	§	‡	30,700
1922	†	†3,670	5,207	20,403	‡900	§5,642	§	‡	35,822
1923	†	†4,420	6,380	24,665	‡1,055	§5,700	§	‡	42,220
1924	†	†5,070	7,010	25,895	‡1,225	§5,800	§	‡	45,000
1925	†	†5,930	8,850	28,296	‡1,345	§5,800	§	‡	50,221
1926	723	6,727	9,485	31,992	1,589	4,951	426	196	56,089
1927	861	7,538	10,766	34,539	1,741	5,039	504	262	61,251
1928	1,387	8,420	11,692	37,715	1,911	4,991	560	312	66,988
1929	1,602	9,526	13,106	42,971	2,038	5,049	590	412	75,294
1930	1,789	10,703	13,944	40,148	2,227	4,996	591	508	74,906
1931	1,879	11,373	13,544	36,937	2,330	4,549	626	664	71,902
1932	1,579	11,494	12,106	30,965	2,033	4,040	568	926	63,711
1933	1,633	11,358	11,589	33,857	1,893	3,991	668	927	65,916
1934	1,858	12,233	12,278	36,943	1,896	4,237	692	945	71,082
1935	1,693	13,496	13,588	40,864	2,078	4,194	841	842	77,596
1936	2,138	14,992	15,612	48,655	2,223	4,401	1,115	908	90,044
1937 *	2,660	16,930	18,410	52,640	2,100	4,420	1,280	860	99,300

Sources: 1920–1925, *Electrical World:* 1926–1937, Edison Electric Institute.
* Ten months actual, two months estimated.
† Farm included with residential.
‡ Municipal and miscellaneous combined in municipal street lighting.
§ Electrified railways combined in street railways.







REVENUE

Income 2.2 Billion — Up 7.6 per Cent
One-third Is Residential Revenue
Farm Revenue Up 40 per Cent in Two Years

HIGH-WATER marks for all time were established by the industry during 1937 in energy sales to ultimate consumers, in number of consumers connected to the lines and, as shown here, in revenues. Three important points summarize the story of revenues received by the utility industry during 1937.

Point No. 1—The bills paid by all consumers for all their service in 1937 exceeded 1936 by $155,500,000, or 7.6 per cent. For this 7.6 per cent increase in the bill customers received 10.3 per cent more kilowatt-hours. The percentage increase in usage was nearly half as much again the percentage increase in the bill.

Point No. 2—Presenting a highly compact picture of the financial condition of the industry, we note total revenue of $2,200,000,000 from ultimate consumers. To this should be added an estimated $176,000,000 from other sources, making a total of $2,376,000,000. From this amount there was paid out in 1937 $1,028,000,000 for operating expenses and maintenance and a tax bill of $307,000,000 by private utilities alone, leaving only $1,041,000,000 for fixed charges, interest and dividend requirements.

A year ago the corresponding figures for gross and net were $2,208,087,000 and $985,587,000. Thus, while the gross increased $168,000,000 the net before charges increased only $55,000,000.

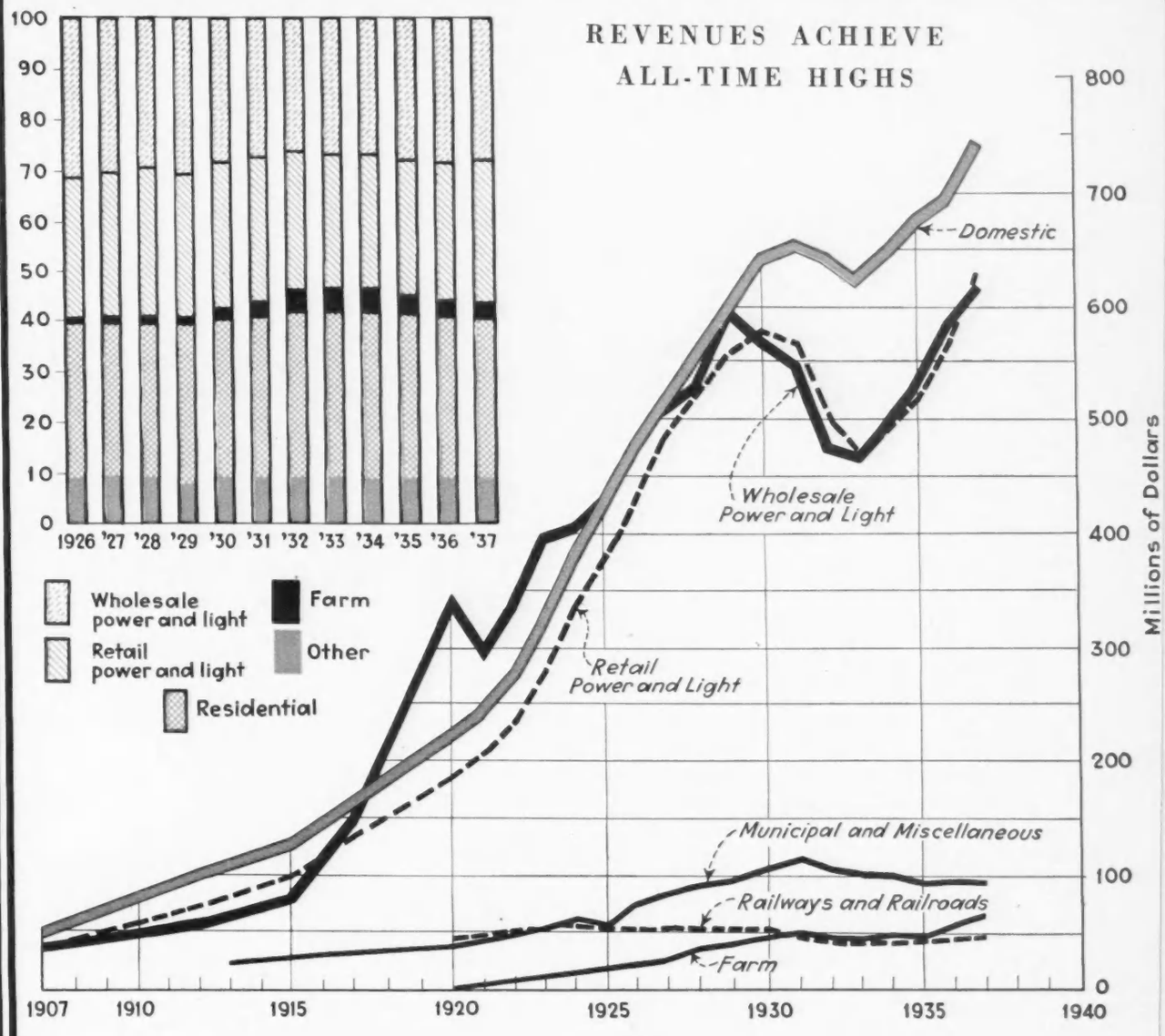
Point No. 3—To complete the over-all picture of revenue, it may be noted that the grand total of 99,300,000,000 kw.-hr. was sold for a gross figure of $2,200,000,000. The over-all average rate is thus calculated to be 2.22 cents.

Just as new high totals were reached in farm and residential usage during 1937, so also new high totals were reached in these revenues during 1937. Farm revenues of $67,400,000 were 13.7 per cent above the previous year, for which, however, the farmer received 24.4 per cent more kilowatt-hours. The recent vigorous growth in farm usage, double in the last nine years, has been at the expense of a steadily declining average bill.

The record-breaking total residential usage of 16,930,000,000 kw.-hr. produced a record-breaking revenue of $740,100,000. This total is 6.1 per cent above 1936, and for this increase in revenue residential customers received 12.9 per cent more kilowatt-hours. Therefore, again this year, the percentage increase in usage was about double the percentage increase in revenue.

Most interesting aspect of commercial small light and power revenue for 1937 is that for the first time since 1933 revenue from commercial business now exceeds revenue from industrial business. In other words, the industrial customers, taking almost three times as many kilowatt-hours, paid less, *in toto*, than the commercial retail customers.

Combining the two groups because of recent changes in classification, all classes of commercial customers in 1937 paid $1,246,860,000, well over half the total, and 9.1 per cent more than in 1936.



REVENUE from Ultimate Consumers in Thousands of Dollars

Year	Farm	Residential	Commercial Small Light and Power	Commercial Large Light and Power	Municipal Street Lighting	Street and Interurban Electric Railways	Electrified Divisions and Steam Railroads	Municipal and Miscellaneous	Total Revenue to Ultimate Consumers
1920....	†	†223,500	185,400	337,500	‡39,320	§42,000	§	‡	827,720
1921....	†	†246,400	204,100	295,000	‡43,500	§44,650	§	‡	833,650
1922....	†	†275,890	231,888	334,788	‡49,151	§50,750	§	‡	942,467
1923....	†	†323,000	276,800	393,000	‡54,750	§52,200	§	‡	1,099,750
1924....	†	†381,400	331,000	402,000	‡60,700	§54,400	§	‡	1,229,500
1925....	†	†422,000	372,000	423,000	‡58,700	§53,270	§	‡	1,328,970
1926....	21,637	469,272	427,407	476,187	68,023	47,617	4,372	5,641	1,520,159
1927....	25,329	512,329	482,135	504,488	77,248	47,965	5,172	5,747	1,661,032
1928....	36,540	555,894	519,957	529,173	83,024	46,488	5,559	7,670	1,784,309
1929....	40,665	600,265	555,640	591,038	88,323	46,277	5,986	10,322	1,938,520
1930....	46,689	642,275	575,598	566,467	95,458	46,067	6,015	12,382	1,990,955
1931....	50,726	653,282	564,523	544,728	99,298	41,912	6,725	14,746	1,975,944
1932....	47,127	640,384	500,993	474,424	89,828	36,701	6,181	18,076	1,813,717
1933....	46,501	623,797	471,780	468,389	83,097	35,098	6,658	19,243	1,754,366
1934....	49,182	648,801	490,420	499,451	81,846	36,402	6,680	19,085	1,831,870
1935....	48,404	673,526	519,213	531,106	79,429	36,431	7,944	15,933	1,911,988
1936....	59,286	696,997	562,122	581,148	80,791	37,423	9,591	17,225	2,044,586
1937*...	67,400	740,100	628,600	618,260	79,840	37,140	10,790	17,870	2,200,000

Sources: 1920–1925, *Electrical World*, estimated allocations; 1926–1937, Edison Electric Institute.
* Ten months actual, two months estimated.
† Farm included with residential.
‡ Municipal and miscellaneous combined in municipal street lighting.
§ Electrified railroads combined with street railways.

AVERAGE REVENUE

Annual Bills and Usage at New Highs
Average Rates at New Lows

IT IS SHOWN elsewhere in this issue that in 1937 the utility industry sold more power to more customers than ever before and from these sales derived higher revenues than ever before.

Just as important is the fact that residential service, commercial service and industrial service were sold at lower average rates than ever before. Couple to this statement the fact that average annual bills are higher than ever before and the result is eloquent testimony to the vigor and efficacy of the industry's load-building efforts during 1937.

In the residential field, for example, it is seen that average usage reached a new high of 797 kw.-hr. But as the average rate dropped to a new low of 4.37 cents, the average bill was only $34.83. Credit for this record can be attributed only to the broad scale sale and promotion by utilities and dealers of the three major appliances, of residential lighting and of the minor load builders in great volume. The accelerated growth last year, represented by an increase of 70 kw.-hr. in the average usage, is topped in only one year, 1930, when 71 kw.-hr. were added to average usage. However, in 1930 the average rate was 6 cents, so that the coming year should see added impetus to load building, due (1) to the fact that the average rate is so much lower and (2) to the need of the companies for more revenue to replace industrial losses.

The addition of 70 kw.-hr. in 1937 is an achievement in accelerated load growth. For in 1936 only 58 kw.-hr. were added, in 1935 only 45 kw.-hr. were added and in 1934 only 31.

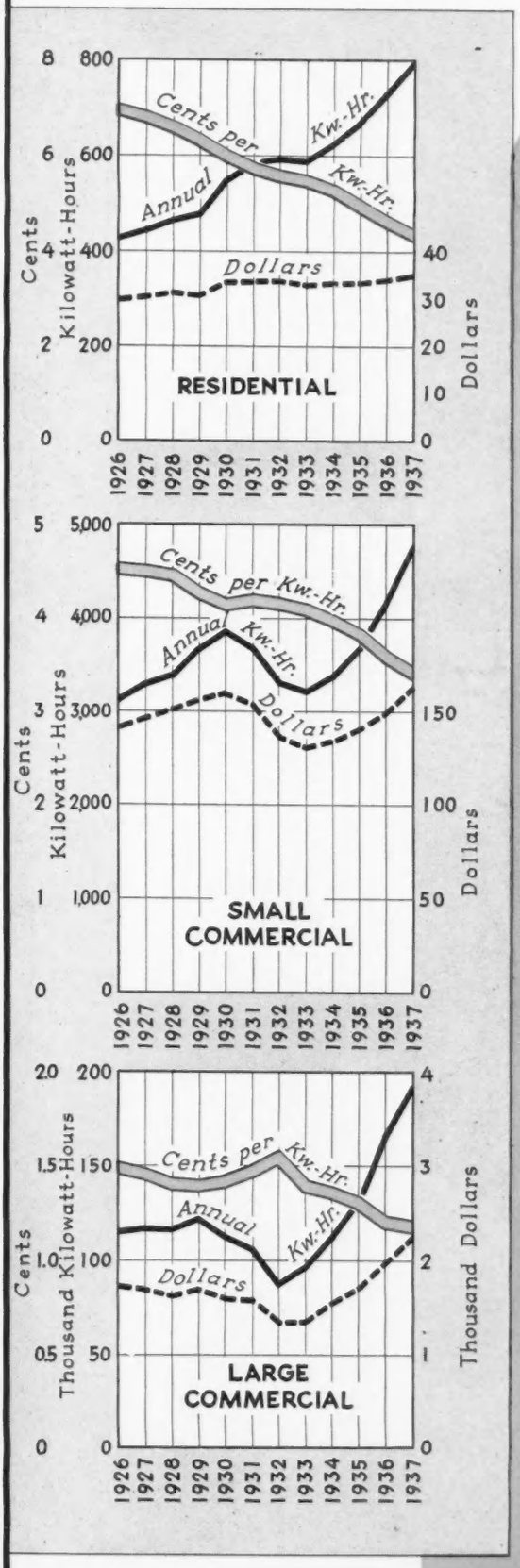
Results of intelligence used in load building are seen in the fact that the average bill increased by $1.02. Selective selling, embracing the higher steps of the rate schedule, has been enough to offset added sales of service at the tail end of the rate and sales efforts in 1938 should be continued along these same lines.

Commercial retail sales in 1937 show upon analysis the same generally favorable characteristics. Average usage and the annual bill are at a new high, rate of growth is accelerating and still service was sold at a new low of 3.41 cents. The general improvement in retail business, coupled with more intensive development of this load, resulted in the largest growth in usage on record.

Just four months ago utility commercial cooking activities were co-ordinated on a national scale jointly with manufacturers of commercial equipment. This new cooking council and the lighting sales committee efforts should result in a co-ordination of effort that will speed further the fast growth of commercial sales.

Industrial business was sold in 1937 at the lowest point in history—1.17 cents per kilowatt-hour. The usage per customer has more than doubled in the past five years, while the bill has been increased by only 70 per cent. With such low average rates, industrial power salesmen will probably sell more equipment in 1938, sell more diversified equipment and a longer use per year to cushion this load against abrupt changes.

AVERAGE REVENUE INCREASING DESPITE LOWER AVERAGE RATES



RESIDENTIAL SERVICE
to Urban and Non-Farm Homes

Year	Kw.-Hr. per Customer	Average Annual Bill (Dollars)	Revenue per Kw.-Hr. (Cents)
1926	428	29.87	6.98
1927	444	30.19	6.80
1928	463	30.76	6.60
1929	477	30.05	6.30
1930	548	32.88	6.00
1931	580	33.29	5.74
1932	597	33.25	5.57
1933	593	32.56	5.49
1934	624	33.07	5.30
1935	669	33.38	4.99
1936	727	33.81	4.65
1937*	797	34.83	4.37

COMMERCIAL SERVICE
Small Light and Power

1926	3,119	141	4.51
1927	3,307	148	4.48
1928	3,397	151	4.45
1929	3,681	156	4.24
1930	3,863	160	4.13
1931	3,686	154	4.17
1932	3,304	137	4.14
1933	3,208	131	4.07
1934	3,368	134	3.99
1935	3,682	141	3.82
1936	4,143	149	3.60
1937*	4,788	163	3.41

COMMERCIAL SERVICE
Large Power and Light

1926	115,513	1,721	1.49
1927	116,006	1,694	1.46
1928	115,344	1,615	1.40
1929	121,150	1,672	1.38
1930	112,331	1,584	1.41
1931	106,291	1,562	1.47
1932	86,118	1,318	1.53
1933	95,986	1,325	1.38
1934	112,263	1,516	1.35
1935	130,112	1,691	1.30
1936	166,442	1,981	1.19
1937*	193,169	2,260	1.17

TOTAL COMMERCIAL SERVICE
Small and Large Light and Power

1926	12,501	273	2.18
1927	12,751	278	2.18
1928	13,110	278	2.12
1929	14,322	292	2.04
1930	13,634	288	2.11
1931	12,550	276	2.20
1932	10,705	242	2.26
1933	11,462	237	2.07
1934	12,384	249	2.01
1935	13,597	262	1.93
1936	15,828	282	1.78
1937*	17,255	302	1.75

* Ten months actual, two months estimated.

CUSTOMERS

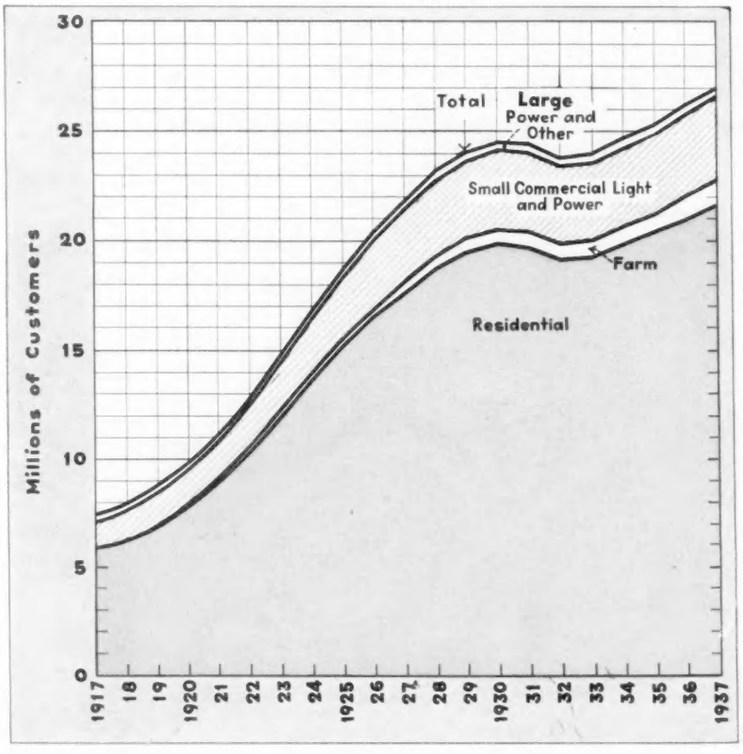
27,000,000 Customers
84 per Cent Domestic and Rural
Nearly 800,000 Added in 1937

AT THE year-end the public utility industry was serving more customers than ever before in its 54 years of existence. The total of 27,000,000 was more than three-quarters of a million above last year, approximately the same numerical gain as was made last year, an evidence of solid over-all growth as business conditions generally improved.

Again in 1937 it was demonstrated that the residential field (domestic and rural) is now and will continue to be of greatest importance to utility management. These two classifications alone represented 84 per cent of the number of customers served.

The percentage gain for 1937 over 1936 was 3.02 per cent for total customers, 2.93 per cent for domestic customers, a highly laudable gain of 15 per cent for farm customers and a gain of 1.04 per cent in the number of commercial lighting and small power customers. The number of wholesale power customers, on the other hand, declined by some 15,000. The changes in the two latter groups were due partly to reclassifications. Total commercial customers increased 0.6 per cent.

The decrease in wholesale users has not been particularly disturbing to utility management, however, because since 1932 the kilowatt-hour sales to these customers have steadily advanced until now they are at an all-time high of 53,000,000,000 kw.-hr. and the revenue at an all-time high of $618,000,000.



CENTRAL STATION CUSTOMERS at End of Year

Regional or State	Total Number			Farms Served			Domestic			Commercial Lighting and Small Power			Wholesale Power		Municipal, Rail and Miscellaneous	
	1936	1937*	Change in 1937	1936	1937*	Change in 1937	1936	1937*	Change in 1937	1936	1937*	Change in 1937	1936	1937*	1936	1937*
UNITED STATES	**26,205,879**	**27,000,000**	**794,121**	**1,042,924**	**1,200,000**	**157,076**	**20,987,440**	**21,600,000**	**612,560**	**3,825,289**	**3,865,000**	**39,711**	**280,024**	**265,000**	**70,202**	**70,000**
NEW ENGLAND	**2,343,651**	**2,378,500**	**34,849**	**78,691**	**83,400**	**4,709**	**1,918,523**	**1,948,000**	**29,477**	**303,483**	**304,900**	**1,417**	**38,062**	**37,800**	**4,892**	**4,400**
Maine	201,568	206,400	4,832	15,760	18,500	2,740	150,707	152,500	1,793	30,941	31,300	359	2,674	2,800	1,486	1,300
New Hampshire	133,099	132,800	—299	11,428	11,000	—428	100,103	100,300	197	17,027	17,100	73	3,119	3,100	1,422	1,300
Vermont	85,005	82,800	—2,205	8,296	8,500	204	61,681	60,100	—1,581	12,209	11,600	—609	2,271	2,300	548	300
Massachusetts	1,260,218	1,277,300	17,082	20,951	21,500	549	1,053,470	1,070,000	16,530	165,548	167,000	1,452	18,995	17,600	1,254	1,200
Rhode Island	195,383	199,000	3,617	3,769	3,900	131	165,249	168,300	3,051	23,175	23,400	225	3,151	3,300	39	100
Connecticut	468,378	480,200	11,822	18,487	20,000	1,513	387,313	396,800	9,487	54,583	54,500	—83	7,852	8,700	143	200
MIDDLE ATLANTIC	**7,204,305**	**7,373,400**	**169,095**	**164,998**	**192,000**	**27,002**	**5,882,389**	**6,022,000**	**139,611**	**1,072,847**	**1,078,600**	**5,753**	**70,793**	**66,000**	**13,278**	**14,800**
New York	3,793,028	3,868,300	75,272	75,090	88,000	12,910	3,088,106	3,152,800	64,694	577,362	580,500	3,138	47,135	41,400	5,335	5,600
New Jersey	1,178,044	1,218,300	40,256	16,443	18,500	2,057	964,218	998,900	34,682	193,169	196,100	2,931	2,695	2,600	1,519	2,200
Pennsylvania	2,233,233	2,286,800	53,567	73,465	85,500	12,035	1,830,065	1,870,300	40,235	302,316	302,000	—316	20,963	22,000	6,424	7,000
EAST NORTH CENTRAL	**6,239,743**	**6,424,000**	**184,257**	**268,472**	**324,000**	**55,528**	**5,077,399**	**5,207,000**	**129,601**	**832,620**	**832,500**	**—120**	**43,336**	**44,100**	**17,916**	**16,400**
Ohio	1,709,417	1,756,900	47,483	74,476	88,000	13,524	1,402,734	1,430,800	28,066	214,841	220,300	5,459	13,495	13,600	3,871	4,200
Indiana	740,190	766,800	26,610	42,839	50,000	7,161	586,322	603,500	17,178	98,435	100,600	2,165	8,204	8,200	4,390	4,500
Illinois	1,921,722	1,960,100	38,378	40,987	48,000	7,013	1,604,705	1,644,400	39,695	259,019	252,100	—6,919	10,877	11,400	6,134	4,200
Michigan	1,183,967	1,238,000	54,033	63,729	82,500	18,771	956,485	990,700	34,215	159,104	160,000	896	3,513	3,600	1,136	1,200
Wisconsin	684,447	702,200	17,753	46,441	55,500	9,059	527,153	537,600	10,447	101,221	99,500	—1,721	7,247	7,300	2,385	2,300
WEST NORTH CENTRAL	**2,500,057**	**2,559,400**	**59,343**	**106,767**	**119,900**	**13,133**	**1,956,510**	**2,004,000**	**47,490**	**410,661**	**412,000**	**1,339**	**18,829**	**15,600**	**7,290**	**7,900**
Minnesota	521,734	530,400	8,666	15,140	17,500	2,360	410,444	415,900	5,456	92,850	93,600	750	2,257	1,800	1,043	1,600
Iowa	492,029	503,600	11,571	36,406	40,000	3,594	380,638	389,100	8,462	71,469	70,600	—869	2,361	2,700	1,155	1,200
Missouri	724,881	749,200	24,319	22,308	25,000	2,692	584,099	606,600	22,501	112,924	112,600	—324	4,258	3,700	1,292	1,300
North Dakota	77,233	78,800	1,567	2,434	3,000	566	54,821	55,700	879	18,586	19,000	414	1,048	700	344	400
South Dakota	89,525	90,700	1,175	3,038	3,400	362	66,881	67,900	1,019	17,452	17,500	48	1,811	1,500	343	400
Nebraska	248,194	253,700	5,506	10,899	13,000	2,101	193,137	196,700	3,563	40,467	40,900	433	2,635	2,100	1,056	1,000
Kansas	346,461	353,000	6,539	16,542	18,000	1,458	266,490	272,100	5,610	56,913	57,800	887	4,459	3,100	2,057	2,000
SOUTH ATLANTIC	**2,101,766**	**2,224,800**	**123,034**	**97,245**	**120,700**	**23,455**	**1,683,506**	**1,764,000**	**80,494**	**299,410**	**318,800**	**19,390**	**15,615**	**14,700**	**5,990**	**6,600**
Delaware	52,579	54,600	2,021	2,389	2,700	311	41,077	42,700	1,623	8,570	8,500	—70	285	500	258	200
Maryland, Dist. of Columbia	520,428	539,100	18,672	15,187	15,000	—187	443,388	450,000	6,612	59,487	71,800	12,313	1,846	1,800	520	500
Virginia	312,091	335,100	23,009	19,292	22,000	2,708	241,937	260,700	18,763	46,056	48,200	2,144	3,913	3,600	893	600
West Virginia	220,245	235,800	15,555	7,237	11,000	3,763	177,966	188,800	10,834	33,075	34,000	925	1,690	1,700	277	300
North Carolina	316,067	337,900	21,833	23,148	32,000	8,852	253,047	264,600	11,553	34,547	36,500	1,953	4,078	3,100	1,247	1,700
South Carolina	130,185	136,600	6,415	11,671	14,500	2,829	95,764	98,800	3,036	20,802	21,100	298	1,414	1,500	534	700
Georgia	260,354	277,400	17,046	11,433	16,000	4,567	197,128	207,800	10,672	50,362	52,100	1,738	968	1,000	463	500
Florida	289,817	308,300	18,483	6,888	7,500	612	233,199	250,600	17,401	46,511	46,600	89	1,421	1,500	1,798	2,100
EAST SOUTH CENTRAL	**905,256**	**950,200**	**44,944**	**50,540**	**60,000**	**9,460**	**687,243**	**724,000**	**36,757**	**151,415**	**152,000**	**585**	**11,713**	**9,500**	**4,345**	**4,700**
Kentucky	297,907	305,900	7,993	9,940	11,000	1,060	236,407	243,800	7,393	42,366	44,000	1,634	7,282	5,000	1,912	2,100
Tennessee	289,835	304,500	14,665	20,362	22,000	1,638	219,122	233,600	14,478	47,382	46,100	—1,282	2,041	1,800	928	1,000
Alabama	206,477	224,200	17,723	14,200	20,000	5,800	153,805	164,000	10,195	37,030	38,600	1,570	965	1,100	477	500
Mississippi	111,037	115,600	4,563	6,038	7,000	962	77,909	82,600	4,691	24,637	23,300	—1,337	1,425	1,600	1,028	1,100
WEST SOUTH CENTRAL	**1,445,981**	**1,527,400**	**81,419**	**44,819**	**55,000**	**10,181**	**1,110,741**	**1,174,000**	**63,259**	**252,962**	**261,800**	**8,838**	**28,587**	**26,700**	**8,872**	**9,900**
Arkansas	131,284	140,900	9,616	5,562	7,500	1,938	95,699	102,400	6,701	26,163	27,500	1,337	2,215	2,000	1,645	1,500
Louisiana	235,193	249,400	14,207	7,034	8,000	966	186,848	198,700	11,852	37,562	39,100	1,538	2,455	2,200	1,294	1,400
Oklahoma	291,259	301,500	10,241	7,491	9,500	2,009	219,433	228,000	8,567	49,963	51,100	1,137	12,482	11,100	1,890	1,800
Texas	788,245	835,600	47,355	24,732	30,000	5,268	608,761	644,900	36,139	139,274	144,100	4,826	11,435	11,400	4,043	5,200
MOUNTAIN	**715,271**	**739,200**	**23,929**	**59,404**	**63,000**	**3,596**	**537,619**	**556,000**	**18,381**	**103,243**	**104,700**	**1,457**	**13,596**	**14,000**	**1,409**	**1,500**
Montana	100,351	104,500	4,149	3,612	3,800	188	79,395	82,800	3,405	16,658	17,100	442	527	600	159	200
Idaho	95,649	100,000	4,351	17,958	19,400	1,442	63,490	65,900	2,410	13,231	14,100	869	831	400	139	200
Wyoming	37,832	38,800	968	1,548	1,600	52	29,009	29,800	791	6,172	6,200	28	1,039	1,100	64	100
Colorado	217,867	225,000	7,133	8,752	9,200	448	171,580	177,700	6,120	28,916	29,100	184	8,408	8,800	211	200
New Mexico	43,473	45,100	1,627	2,000	2,100	100	32,038	33,400	1,362	8,755	8,800	45	540	600	140	200
Arizona	75,978	77,500	1,522	6,409	6,400	—9	56,783	58,100	1,317	12,297	12,400	103	223	300	266	300
Utah	120,296	122,900	2,604	17,854	19,200	1,346	87,479	88,900	1,421	12,903	12,500	—403	1,900	2,100	160	200
Nevada	23,825	25,400	1,575	1,271	1,300	29	17,845	19,400	1,555	4,311	4,500	189	128	100	270	100
PACIFIC	**2,749,849**	**2,823,100**	**73,251**	**171,988**	**182,000**	**10,012**	**2,133,510**	**2,201,000**	**67,490**	**398,648**	**399,700**	**1,052**	**39,493**	**36,600**	**6,210**	**3,800**
Washington	455,679	468,200	12,521	42,289	47,000	4,711	352,062	359,600	7,538	55,822	56,400	578	4,060	4,200	1,446	1,000
Oregon	260,660	269,000	8,340	25,917	28,000	2,083	193,797	199,800	6,003	37,430	37,100	—330	2,762	3,000	754	1,100
California	2,033,510	2,085,900	52,390	103,782	107,000	3,218	1,587,651	1,641,600	53,949	305,396	306,200	804	32,671	29,400	4,010	1,700

* Estimate based on first ten months of the year.

RURAL

Utilities Add 160,000 New Farm Customers
Average Bill Slightly Lower with Higher Usage
1938 Construction Down

DURING 1937 the public utility companies of the United States took electric service for the first time to 160,000 farms, the number predicted by ELECTRICAL WORLD a year ago. The total is now 1,200,000, or 27.7 per cent of all farms having dwellings in excess of $500.

The industry thus continued the record-breaking pace established in 1936, and in both 1936 and 1937 connected 40 times as many new farm customers as it did as recently as in the year 1933.

REA estimates that at the end of 1937 approximately 50,000 customers were receiving energy from lines financed by REA funds. The total number of farms receiving service is therefore approximately 1,250,000—28.8 per cent of the farms with dwellings valued in excess of $500.

If we add to this figure the 280,000 farms reached by utility lines which, however, do not yet utilize the service, the total having service available becomes 1,530,000 and the percentage 36.3.

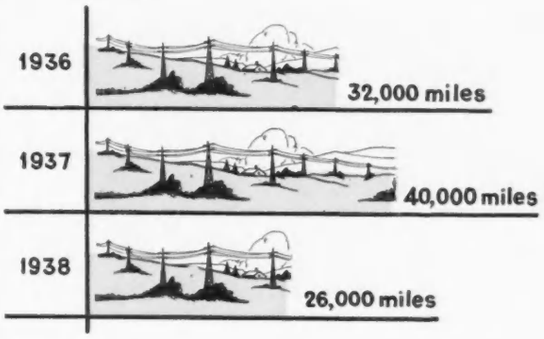
Turning now to rural construction, we find that utility companies constructed the tremendous total of 39,612 miles of line in the past twelve months, a 25 per cent gain over the 32,000 miles of line constructed in 1936.

At this point it is necessary to call attention to the fact that while 26,000 additional miles of rural construction are budgeted for 1938, this total, though some 20 per cent below 1936 construction and only 65 per cent of the total for 1937, may be higher when many companies later budget their construction program.

Influences of great weight in reducing this total for 1938 construction have been: First, the difficulty now being experienced by utilities in getting new money; second, the difficulty in finding any but thin territory for 1938 extensions, and, third, the pressing need for finding some way of building up earnings on present rural lines.

For every 4 1/3 farms now receiving electric service there is another farm reached by the utilities' lines which is not availing itself of the service. Furthermore, the average farm bill (for farms east of the 100th meridian) dropped in 1937 from $48.65 per year to $48.50, the lowest figure in at least ten years.

The only remedy for this unhealthy situation is a vigorous load-building campaign. The companies will need to sell that one customer in every 4 1/3 upon utilizing the electric service that now passes by his farm and find ways and means of reversing the present trend in income. In 1937, it should be emphasized, the average rural customer purchased 1,059 kw.-hr., a gain of 105 kw.-hr. per year, but he paid 15 cents less for it. His average annual bill dropped to $48.50, his average rate to 4.58 cents, about one-half the rate he paid only ten years ago, and, incidentally, only 2.1 mills higher than his city cousin.



MILES OF RURAL LINES

	Built During		Prospective	Customers*
	1936	1937	1938	1936
New England	913	1,055	868	4,395
Mid. Atlantic	6,950	6,340	3,132	33,680
E. No. Central	10,390	14,050	8,658	50,100
W. No. Central	2,212	3,225	3,213	10,250
So. Atlantic	5,575	6,190	3,835	32,540
E. So. Central	1,870	3,282	1,385	12,100
W So. Central	1,737	3,220	2,976	9,270
Mountain	723	535	528	5,275
Pacific	1,609	1,715	1,475	11,860
United States	**31,979**	**39,612**	**26,070**	**169,470**

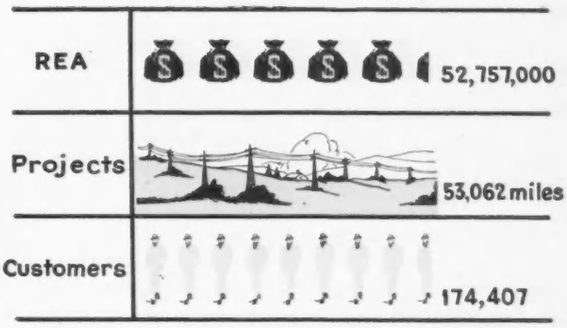
* Customers added on the new rural lines in 1936.

RURAL ELECTRIFICATION ADMINISTRATION VOLUME OF CONSTRUCTION RELEASED

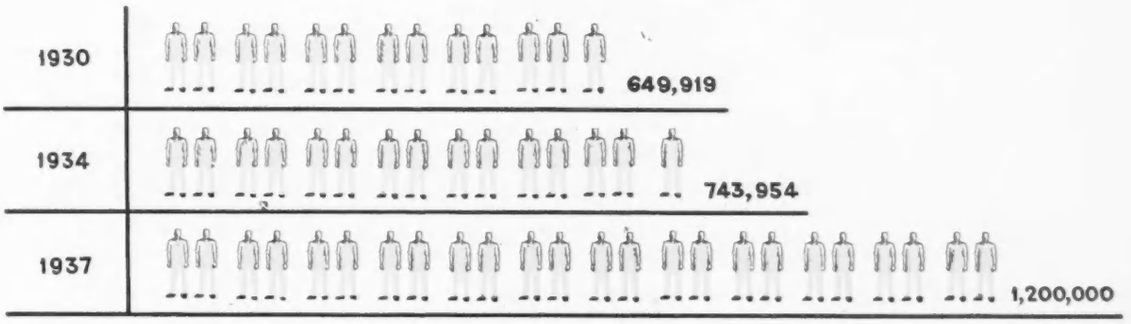
(As of November 15, 1937)

Region	Amount (Dollars)	Miles	Customers
New England	.....	.....	.....
Middle Atlantic	2,073,922.59	2,049.00	6,876
East No. Central	18,608,521.65	18,366.25	60,619
West So. Central	5,254,556.01	6,187.95	19,789
So. Atlantic	6,410,891.89	6,514.98	27,583
East So. Central	4,033,394.76	4,121.33	16,667
West No. Central	13,802,460.53	13,447.8	35,184
Mountain	1,659,778.31	1,630.27	5,512
Pacific	913,306.89	745.00	2,177
United States	**52,756,832.63**	**53,062.58**	**174,407**

Of total amount $1,162,520.88 was for generating plants.



Each money bag represents 10,000,000 dollars
Each figure represents 20,000 customers



Each figure represents 50,000 farm customers

NUMBER OF FARMS SERVED, BY GEOGRAPHICAL REGIONS, End of Each Year

Region	1930	1931	1932	1933	1934	1935	1936	1937	Farms with Dwellings Valued Over $500	Per Cent Served 1937
New England	48,996	52,237	54,204	55,725	58,006	59,804	78,691	83,400	141,366	59.0
Mid. Atlantic	96,342	104,911	108,934	109,001	118,169	124,446	164,998	192,000	367,118	52.3
E. No. Central	151,113	166,893	169,343	172,467	181,261	199,077	268,472	324,000	952,094	34.0
W. No. Central	82,283	89,717	89,652	89,460	91,398	94,608	106,767	119,900	976,203	12.3
So. Atlantic	42,539	47,958	49,730	50,558	53,307	60,096	97,245	120,700	585,103	20.6
E. So. Central	29,949	31,513	31,176	30,311	32,062	34,485	50,540	60,000	419,605	14.3
W. So. Central	21,438	22,170	22,653	22,371	22,883	25,036	44,819	55,000	493,229	11.2
Mountain	42,536	44,308	45,726	46,516	47,876	50,405	59,404	63,000	166,065	37.9
Pacific	134,723	139,079	138,031	137,149	138,992	140,838	171,988	182,000	227,309	80.1
United States	**649,919**	**698,786**	**709,449**	**713,558**	**743,954**	***788,795**	**1,042,924**	**1,200,000**	**4,328,092**	**27.7**

*Revised total 877,795: regional allocation not available.

EXPENSES

Operating Costs Creep Up on Revenues

Wages Up With Employee Efficiency

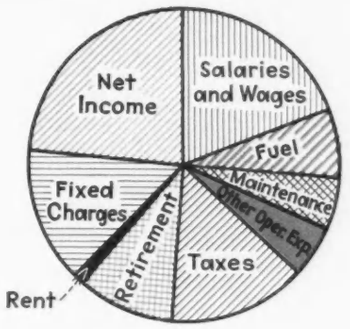
Working Staffs Increased 5 per Cent

OPERATING expenditures of the electric utilities jumped 10 per cent during 1937, while the total revenue went up less than 8 per cent. The expenses take more dollars now than at any time in the history of the industry. Only by skillful handling of revenue and outlay has the operating ratio been held down to the general level established during the past eight years. Back in 1912 it was 53.2. By 1930 this had been brought down to 44. This past year it was 43.2, comparing very favorably with the 41.7 to 43.3 range maintained since 1931. During the last three years, however, there has been a steady rise in the operating ratio (42.0, 42.5, 43.2), showing the effect of rising unit costs for fuel, supplies and labor. Indications are for a continuation of the rise in costs of operation, so the escape from this and more taxes rests solely in selling lots more kilowatt-hours at profitable prices.

Growth in taxes is eating up the savings accruing from the gain in administrative efficiency since pre-depression years. What the industry is now paying in taxes would cover the payrolls of 200,000 more employees at the present scales if utilized for that purpose. One dollar in every six collected by the electric utilities in 1937 went for wages and salaries, while one in every seven went for taxes. Remuneration of the utility employees took a greater part of the revenue of the companies than it has at any time since 1931, so the industry has not been out of step with the general tendency to maintain and restore purchasing power during the recovery period. Average wages per employee per year also support this assertion, because for 1937 they were $1,432, greater than at any time since 1928 and almost equal to the $1,443 figure of 1930. In fact, the average pay of 1937 was some 2 per cent greater than in 1929. The power industry has been able to attain the efficiency that permits lowered rates in part by steadily disposing of more kilowatt-hours per employee. In 1937 this reached 412,000, and this was greater than in 1936 by 3 per cent. During the period from 1929 to 1935 inclusive the utilities had turned out between 306,000 and 377,500 kw.-hr. per year per employee. Fortunately the wholesome growth in output has warranted having within 5½ per cent as many employes as in the peak year of 1929.

For maintenance purposes the industry spent about $115,000,000 in 1937. It expects to spend $5,000,000 more than that in 1938. That is just 1 per cent on a twelve-billion property. It is an extremely modest outlay and sooner or later will have to be increased. Things are not being allowed to go rickety by any means, but for comfortable public relations through good service there will have to be a catch-up expenditure under favorable circumstances to bring the state of diffused little units of operating equipment up to parity with the new major installations to improve reliability and adequacy of service which are being made by means of new capital investments.

ALLOCATION OF REVENUE DOLLAR



WAGES, COST OF FUEL, MAINTENANCE

Private Electric Light and Power Industry

Year	Millions of Dollars			
	Total Operating Revenue	Salaries and Wages	Fuel	Maintenance
1932	1,719	.....	97	84
1933	1,664	310	97	80
1934	1,736	329	116	89
1935	1,813	349	125	96
1936	1,941	360	150	100
1937*	2,086	402	162	103

* Estimated on ten months' operations. Other years from E. E. I.

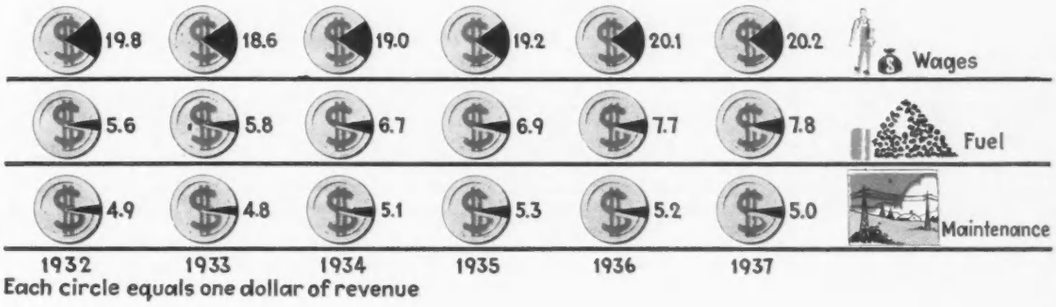
INCOME AND EXPENDITURES

Private Electric Light and Power Industry

Edison Electric Institute. Intercompany transactions eliminated.

	Millions of Dollars				
	1932	1933	1934	1935	1936
Operating Revenue (Electric)					
From ultimate consumers	1,696	1,637	1,706	1,777	1,903
Sales to municipal systems	16	15	15	16	19
Miscellaneous	7	12	15	20	19
Total operating revenue	1,719	1,664	1,736	1,813	1,941
Revenue Deductions (Electric)					
Operating Expenses					
Production	Data	180	201	217	.....
Transmission and distribution	not re-	136	146	152	.....
Utilization	quested	32	34	33	.....
Commercial	from	67	70	72	.....
New business	com-	33	39	47	.....
General and miscellaneous	panies	131	133	139	.....
Total operating expenses	602	579	623	660	723
Uncollectible bills	14	19	13	9	7
Taxes (incl. federal income)	205	215	243	255	285
Retirement expenses	160	170	180	188	200
Total revenue deductions	981	983	1,059	1,112	1,215
Operating Income (Electric)	738	681	677	701	726
Rent (net charge)	10	11	9	10	10
Balance of income before interest and dividend requirements	728	670	668	691	716

SALARIES AND WAGES, FUEL COST, MAINTENANCE, IN PER CENT OF REVENUE



OPERATING EXPENDITURE, OPERATING RATIO, EMPLOYEES

(100 per cent of the industry. Money values in thousands of dollars)

	1912	1917	1922	1927	1929	1930	1931
Revenue from ultimate consumers	.....	.....	.....	.....	1,938,520	1,990,955	1,975,945
Other sources	.....	.....	.....	.....	167,380	160,195	149,166
Total electric	287,138	502,060	1,020,329	1,802,655	2,105,900	2,151,150	2,125,111
Operating expenditures†	152,629	289,912	588,068	828,168	934,890	946,180	913,910
Net (before depr., int. and taxes)	134,509	212,148	487,261	974,487	1,171,010	1,204,970	1,211,201
Operating ratio, per cent	53.2	57.5	52.3	46.0	44.4	44.0	43.0
Salaries and wages‡	61,162	95,242	212,434	390,000	405,000	423,000	392,000
Number of employees	79,335	105,541	150,762	251,020	289,000	298,000	282,000

	1932	1933	1934	1935	1936	1937*	1938
Revenue from ultimate consumers	1,813,717	1,754,366	1,831,871	1,911,989	2,044,587	2,200,000	.....
Other sources	147,394	132,694	143,414	152,764	163,500	176,000	.....
Total electric	1,961,111	1,887,060	1,975,285	2,064,753	2,208,087	2,376,000	.....
Operating expenditures†	817,950	795,811	857,200	867,450	937,500	1,028,000	.....
Net (before depr., int. and taxes)	1,143,161	1,092,249	1,118,085	1,197,303	1,270,587	1,348,000	.....
Operating ratio, per cent	41.7	42.1	43.3	42.0	42.5	43.2	.....
Salaries and wages‡	323,880	292,000	316,000	330,000	360,000	397,500	.....
Number of employees	244,573	232,000	247,000	248,000	264,000	277,500	.....

* Estimated on ten months' operations.
† Includes maintenance but not taxes or depreciation. ‡ Included in operating expenditures.

TAXES

Every Seventh Dollar of Revenue Goes to Taxes

Average Domestic Customer Pays $5.12 in Taxes

Taxes Take 23% of Net Before Depreciation, Interest

EVERY seventh dollar that private electric utilities received in 1937 went to the tax collector. Last year these utilities paid out in taxes 307 millions. It represents some 2.2 per cent on the entire electric utility investment. This was enough to pay more than a third of the 1937 interest on the national debt.

And this is the industry that some people in Washington would turn over to public non-tax-paying ownership!

Taxes have been increasing by leaps and bounds. Five years ago in 1932 they were 205 millions. Last year they were 50 per cent higher. Twenty-five years ago, when taxes represented less than 5 per cent of the operating revenue, they were 13 millions; last year, though the revenue had increased eight times, taxes had increased nearly twenty-four times, absorbing 14.7 per cent of the operating revenue.

Is there a limit? Perhaps there will be when the industry heeds the suggestion of the New York State Commissioner of Taxes that the public be told how much taxes figure in the electric light bill. Does the average residential customer know that in 1913 his annual bill was $22.97, out of which he paid $1.12 in taxes, but that last year out of his bill of $34.83 he paid $5.12 in taxes? Does he know that while his 1937 bill was $1.68 more than it was in 1932 73 per cent of this increase, or $1.16, went to the tax collector?

Does the average utility employee realize that while the increase in payroll last year amounted to 37½ millions, the increase in taxes amounted to 22 millions? Does he realize that private electric utilities paid out 79 per cent as much in taxes in 1936 as in salaries and wages? In an industry where the trend of regulation is constantly to hammer rates down, does not a constantly mounting tax bill have some significance to the wage earner?

The full significance of taxes, however, cannot be had by comparing them with the gross. Taxes come out after operating and before depreciation and interest. Twenty-five years ago less than a tenth of net went for taxes; five years ago it was 18 per cent, but last year it was 23 per cent.

During the war the operating ratio got close to 60 per cent, but since then lower priced coal and improved operating and management efficiencies have combined to bring the figure close to 40 per cent. These savings, however, are now being absorbed by higher taxes, so that the combined ratio of operating and taxes is within a few per cent as high as it was during the war.

Already higher costs and higher taxes are forcing certain utilities in other fields to ask for higher rates. The trend of electric rates is still down. With taxes mounting faster than revenue and other operating costs likewise going up, it must be obvious that this trend cannot continue forever—particularly if the return is to be sufficient to attract new capital for construction purposes.

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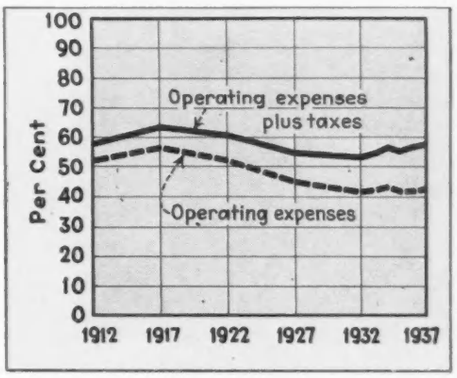
TAXES

Per Residential Customer

Year	Annual Bill	Per Cent Tax	Dollars per Customer
1913.....	$22.97	4.89	1.12
1917.....	20.15	6.43	1.30
1922.....	26.50	8.28	2.19
1927.....	30.19	9.46	2.86
1932.....	33.25	11.9	3.96
1937.....	34.83	14.7	5.12



TAXES PAID

By Private Electric Utilities

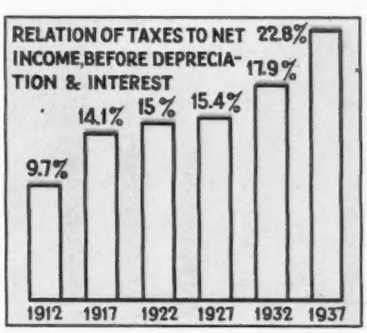
Year	Thousands of Dollars		Per Cent to Operating Revenue
	Operating Revenue	Taxes	
1902*.....	77,132	2,655	3.44
1907*.....	156,447	6,346	4.06
1912*.....	268,360	13,117	4.89
1917*.....	464,881	29,897	6.43
1922*.....	883,334	73,128	8.28
1927*.....	1,588,908	150,253	9.46
1932†.....	1,719,000	205,000	11.9
1933†.....	1,664,000	215,000	12.9
1934†.....	1,736,000	243,000	14.1
1935†.....	1,813,000	255,000	14.1
1936†.....	1,941,000	285,000	14.6
1937‡.....	2,086,000	307,000	14.7

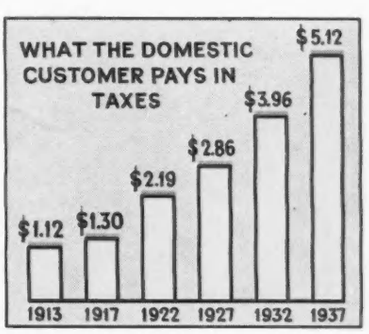
*U. S. Census. †Edison Elec. Inst., Intercompany revenue eliminated. ‡Est. on ten months' operations

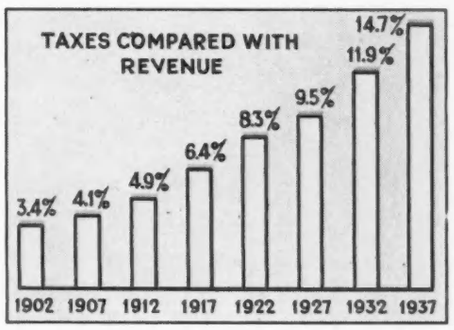
TAXES COMPARED WITH NET

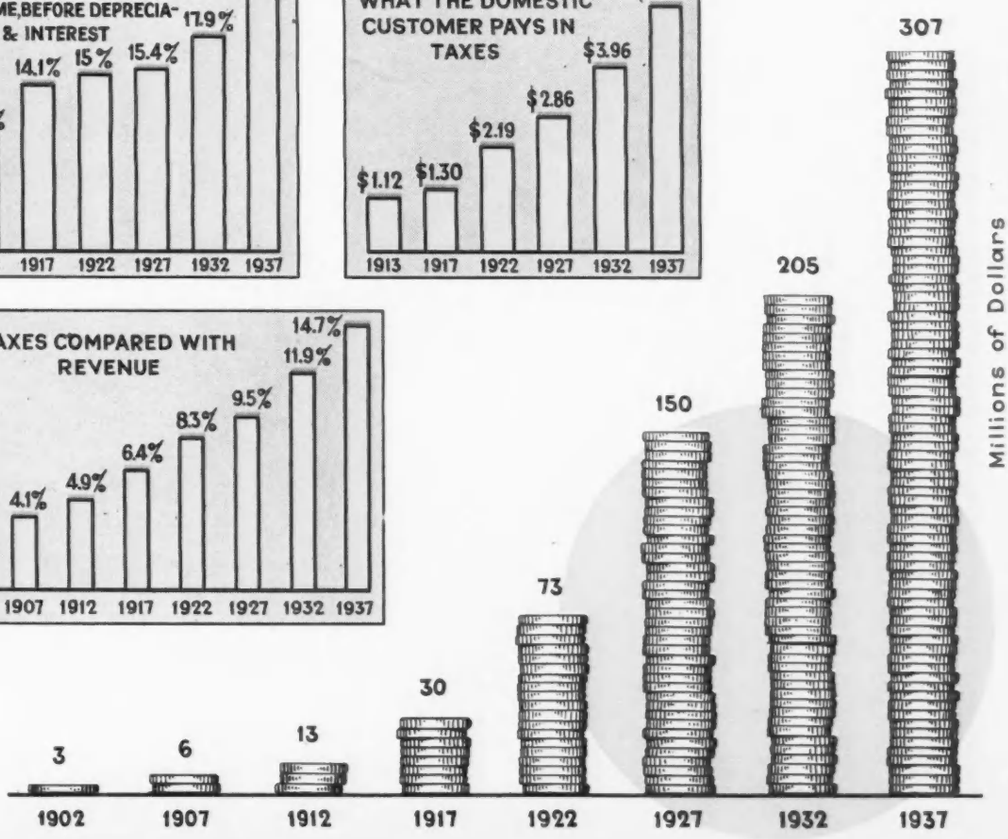
Before Depreciation and Interest

Year	Thousands of dollars		Per Cent
	Net Whole Industry	Taxes, Private Companies	
1912.....	134,509	13,117	9.7
1917.....	212,148	29,897	14.1
1922.....	487,261	73,128	15.0
1927.....	974,487	150,253	15.4
1932.....	1,143,161	205,000	17.9
1933.....	1,092,249	215,000	19.7
1934.....	1,118,085	243,000	21.9
1935.....	1,197,303	255,000	21.3
1936.....	1,270,587	285,000	22.4
1937.....	1,348,000	307,000	22.8









FINANCING

Utilities Raise $81,983,646 in new capital

Total financing for 1937 below preceding year

Capital markets and interest rates remain favorable

THE degree and success with which political problems facing the utilities are met in 1938 will be reflected, and will largely determine, the extent to which the industry will be able to raise new capital and carry out financing programs.

After two years of favorable easy money conditions and low interest rates, during which the utilities did $2,399,610,863 of financing, unstable conditions, brought about by political uncertainty and the Administration's intention to press further its power objectives, faced the industry as 1937 progressed. During the first six months of 1937 the major portion of financing was carried out. The last half saw a sharp break in security prices, following the spring and early summer decline. With confidence shattered and the business recession spreading to all lines, capital markets dried up, but few issues making their appearance.

Electric utilities financed a total of $645,682,394 in securities during 1937, as against $1,331,940,163 in the preceding year and $1,067,670,700 during 1935. Of the 1937 total, $81,983,646 constituted new capital. This compares with $59,727,053 raised in 1936. Of the new capital raised in 1937 a total of $28,701,700 was from private sales of securities and $53,281,946 from public offerings.

Outstanding among large issues during the year were $130,000,000 refunding bonds of Philadelphia Electric and the $95,000,000 of Union Electric of Missouri, of which $80,000,000 was in $3\frac{3}{4}$ per cent bonds and $15,000,000 in 3 per cent notes. Consumers Power refunded its outstanding three issues of preferred stock with a $55,052,694 issue of $4.50 preferred. Northern States Power (Minn.) sold $75,000,000 of $3\frac{1}{2}$s and $28,325,000 of 5 per cent cumulative preferred stock in a refunding program.

At the present time the capital markets for high grade securities appear receptive and are expected to remain so unless there be further currency jiggling.

The extent to which the utilities will come into the capital markets, to finance construction programs and to effect interest savings by refunding operations, will depend upon how far the government is willing to co-operate with the utilities and convince investors that the industry will not be destroyed.

With maturities during 1938 small, there is little pressing need for large scale refinancing. The recession in business and drop in power use may prove important factors when utility managements decide on plans to install additional generating capacity which would necessitate the raising of new capital.

While practically all financing in the past few years has been through the sale of bonds, many utilities still have a comfortable margin yet to go before capital structures become too heavy in funded debt. Considering all factors in the utility situation, indications are that financing during 1938 will, in all probability, be less than last year.

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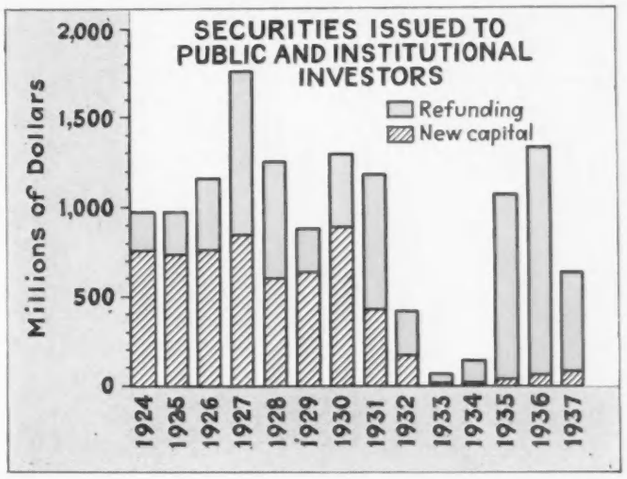
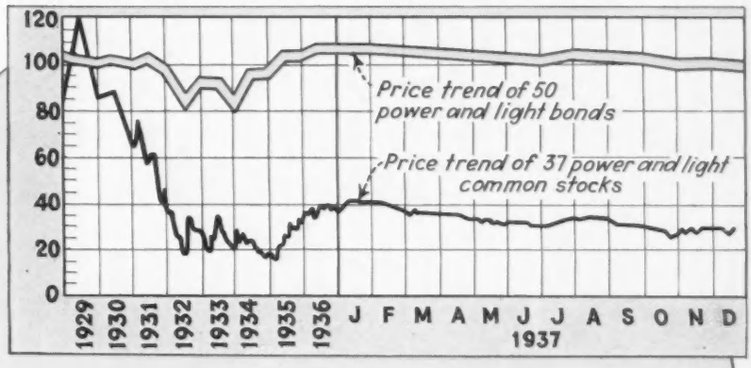
NEW UTILITY FINANCING TOTALS

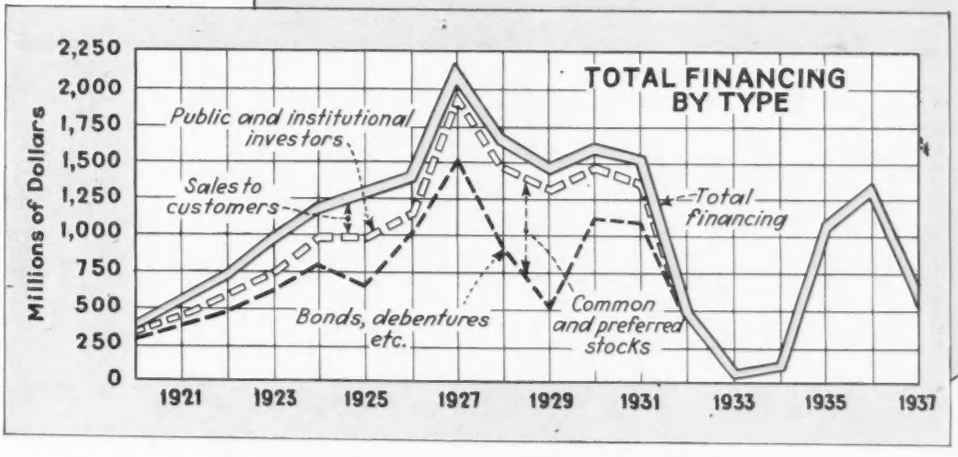
$645,682,394

MORTGAGE BONDS (Av. yield 3.55%)		
No. of Issues	Range of Yield	Amount of Issues
5	3.19–3.35	$50,200,000
4	3.36–3.40	174,529,000
4	3.44–3.53	86,978,000
3	3.60–3.75	85,000,000
5	3.82–3.99	104,264,000
6	4.00–5.00	15,250,000
5	Placed privately	5,226,000
32		$521,447,000
DEBENTURES		
1	2.96	3,500,000
1		3,420,000
2		$6,920,000
NOTES (Average yield 3.22%)		
4	2.91–4.77	29,550,000
2		2,300,000
6		$31,850,000
PREFERRED STOCK (Av. yield 4.63%)		
2	4.47–4.85	83,377,694
2	5.82–5.94	2,087,700
4		$85,465,394
COMMON STOCK		
Rights		*$629,940
TOTAL FINANCING		$645,682,394
REFUNDING		563,698,748
NEW CAPITAL		81,983,646

* Not included in total.







SECURITY SALES BY CLASSES

(In Dollars)

Year	Bonds, Debentures, etc. (a) (1)	Stocks, Common and Pfd.† (2)	Sales to Customers (3)	Total Financing† (4)	Allocation of Public Sales‡		
					New Capital (5)	Refunding (6)	Total Issues (7)
1924	805,338,600	175,582,200	194,200,000	1,175,120,800	759,399,092	223,021,708	982,420,800
1925	668,524,500	313,698,510	296,000,000	1,278,223,010	726,958,210	255,264,800	982,223,010
1926	1,013,160,000	135,504,982	246,900,000	1,395,564,982	757,870,107	393,094,875	1,150,964,982
1927	1,528,632,500	360,276,764	240,000,000	2,128,909,264	830,439,960	913,194,740	1,743,634,700
1928	922,098,100	549,399,409	170,000,000	1,641,497,509	599,808,500	637,411,952	1,237,220,452
1929	523,407,500	792,051,262	145,000,000	1,460,458,762	624,174,000	257,602,000	881,776,000
1930	1,114,636,200	338,217,641	135,000,000	1,587,853,841	894,473,434	403,061,600	1,297,535,034
1931	1,090,584,000	258,658,193	159,000,000	1,508,242,193	424,163,000	758,741,000	1,182,904,000
1932	404,839,800	47,416,808	18,000,000	470,256,608	165,727,800	239,112,000	404,839,800
1933	53,725,000	2,147,778	375,000	56,247,778	6,812,500	46,912,500	53,725,000
1934	131,175,000	.....	.....	131,175,000	2,430,800	128,744,200	131,175,000
1935	1,067,670,700	.....	.....	1,067,670,700	26,496,111	1,041,174,589	1,067,670,700
1936	1,279,681,200	52,258,963	.....	1,331,940,163	59,727,053	1,272,213,110	1,331,940,163
1937	560,217,000	86,095,334	.....	646,312,334	81,983,646	563,698,748	645,682,394

a To public and institutional investors. † Including rights and warrants. ‡ Not including common stock rights and warrants.

BUDGET

Utilities to Spend 473 Millions — Up 4 per Cent

Large Gains for Steam Station Construction

THE electric utilities are planning to spend for new construction $472,640,000 in 1938. This is some 4 per cent more than was spent for that purpose in 1937.

The figures which appear on the opposite page are in all probability a minimum because several companies are holding up a 1938 capital expenditure budget until they get a better picture of the probable trend of business and of the financial market. Also, many companies report that they would increase the budget just as soon as it becomes easier to finance new construction.

Considerable attention has been given to statements that the utilities have a large backlog of capital expenditures for new construction awaiting more favorable conditions. It is true that the prospective program for 1938 is 56 per cent of the average of the five years in which the utility industry made its largest capital expenditures, but there is another way of viewing these figures. Kilowatt-hour consumption is the best index we have of growth. The utility industry sold 24,000,000,000 kw.-hr. more in 1937 than it did in 1929 and spent for new construction in the eight years 1930-1937, inclusive, $3,057,000,000.

The nearest normal period in which there was the same difference in sales was 1925 to 1929, when the capital expenditures for the intervening four years amounted to $3,255,000,000. On this basis, then, it would appear that the industry is underspent up to the end of 1937, so far as new construction to take care of growth is concerned, by only some two hundred millions. There is, of course, an additional amount, no one knows how much, to take care of obsolescence and supercession during the longer period. But if the industry is back on its pre-depression rate of sales increase, the budget for 1938, judging from pre-depression expenditures, is inadequate by at least 300 millions, thus making a 1938 backlog of more than 500 millions.

However, much more increase in load will before long necessitate the provision again of safer margins for current operation and, in a temper of prudence and confidence, a decent margin for further growth. Realization of this, along with the statistically demonstrated backlog of $500,000,000, can easily amount to a total approaching the billion or more outlay which has been cited for the industry "if, as and when."

A study of the figures will show very substantial gains budgeted in 1938 for new steam construction; little or no difference for hydro; about 13 per cent less for transmission; around 8½ per cent less for distribution, and approximately the same for miscellaneous. The major effort, therefore, is being made to build up generating capacity.

Regionally, every section of the country has a larger budget for 1938 than it spent in 1937 with the exception of the South. The reasons for this are obvious.

The capital expenditures table this year has been corrected for the years 1931-1936. Previously, the figures carried were budget figures for each of those years. This year they have been corrected to show actual expenditures.

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All sections have large budgets except the South.

Plans for steam station construction the largest since 1930.

ANNUAL CAPITAL EXPENDITURES FOR NEW CONSTRUCTION

Electric Light and Power Industry

(In Thousands of Dollars)

	Steam	Hydro	Transmission	Distribution*	Miscellaneous	Total
1921	49,858	52,816	60,657	59,077	.....	222,408
1922	100,543	63,790	75,588	84,095	.....	324,016
1923	209,417	74,396	125,200	193,130	.....	602,143
1924	269,700	109,540	134,190	179,010	.....	692,440
1925	240,000	140,000	205,700	135,600	.....	721,300
1926	255,107	145,000	231,061	210,176	.....	841,344
1927	146,017	88,866	163,153	362,317	.....	760,353
1928	171,033	113,841	186,190	267,606	48,308	786,978
1929	182,548	98,912	167,565	361,331	55,988	866,344
1930	207,901	117,395	137,085	432,570	65,938	960,889
1931	104,386	60,317	101,031	269,722	61,284	596,740
1932	40,000	20,000	60,000	140,000	25,000	285,000
1933	10,400	4,000	16,100	87,100	11,700	129,300
1934	10,258	5,704	30,180	88,220	13,292	147,654
1935	16,172	6,337	35,349	117,870	17,127	192,855
1936	36,820	9,030	45,220	174,640	24,000	289,710
1937†	94,870	13,025	80,030	233,500	34,055	455,480
1938‡	141,290	13,850	69,590	212,500	35,410	472,640

* Substations generally with distribution. † Preliminary. ‡ Prospective.

CAPITAL EXPENDITURES

Electric Light and Power Industry

1936 Expenditures	
Generating stations	$45,850,000
Transmission and substations	45,220,000
Distribution	174,640,000
Miscellaneous	24,000,000
Total	$289,710,000
1937 Expenditures (preliminary)	
Generating stations	$107,895,000
Transmission and substations	80,030,000
Distribution	233,500,000
Miscellaneous	34,055,000
Total	$455,480,000
1938 Expenditures (prospective)	
Generating stations	$155,140,000
Transmission and substations	69,590,000
Distribution	212,500,000
Miscellaneous	35,410,000
Total	$472,640,000

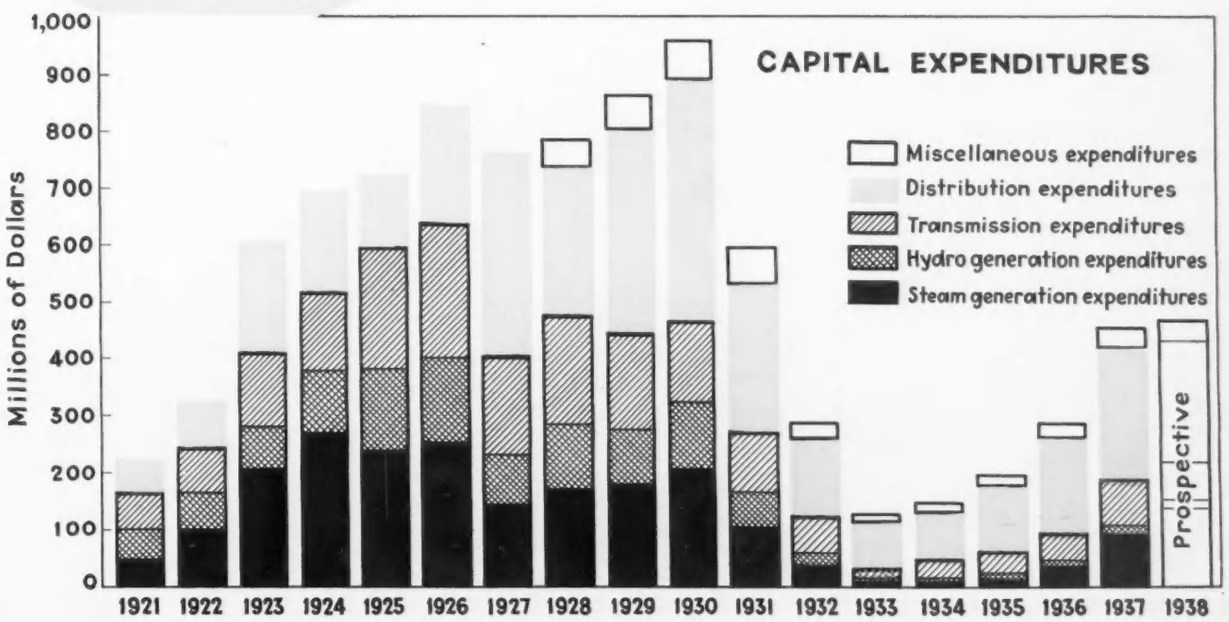
CAPITAL EXPENDITURES, 1937, BY REGIONS

(In thousands of dollars)

Region	Steam	Hydro	Transmission	Distribution	Miscellaneous	Total
East	26,100	2,525	17,300	66,500	9,770	122,195
Central	49,100	1,420	21,610	67,200	13,630	152,960
South	12,050	450	34,800	69,450	8,700	125,450
West	7,620	8,630	6,320	30,350	1,955	54,875
Total	94,870	13,025	80,030	233,500	34,055	455,480

PROSPECTIVE CAPITAL EXPENDITURES, 1938

East	45,800	3,170	13,820	60,300	11,420	134,510
Central	56,950	420	19,100	63,900	15,500	155,870
South	25,200	2,660	27,000	59,200	6,340	120,400
West	13,340	7,600	9,670	29,100	2,150	61,860
Total	141,290	13,850	69,590	212,500	35,410	472,640



ELECTRICAL MANUFACTURING

Production Up 22½ per Cent, Orders 23 per Cent

Greatest Improvement in Heavier Equipment

Employment Grew Faster Than Production

PRODUCTION of electrical manufactures in 1937 fell short of the 1929 peak by only 6.4 per cent. On the basis of census inclusions, the 1937 total is estimated to be $1,400,000,000. The total production last year, which figures, however, include many products not carried as electrical manufactures in the census, is estimated by N.E.M.A. to have totaled $2,376,000,000. This represents an increase over 1935 of 22½ per cent.

During the last four months of the year production declined progressively. Had it been maintained at the same volume as the previous eight months, the year's total in all probability would have surpassed 1929.

Bookings were highest in the first quarter, declining slightly in the second quarter, much more in the third and very materially in the last three months. For the year, however, bookings were approximately 23 per cent greater than in 1936. Production caught up with orders late in the year, with the result that the backlog carry-over to 1938 in most lines will be found to be less than at the beginning of 1937. In the case of very large apparatus, that takes a long time to build, the reverse will be true.

Appliances were 15 per cent ahead of the previous year, which was the first year to surpass 1929. Refrigeration again chalked up a big gain, being nearly 20 per cent ahead of 1936. Construction materials were up 13 per cent and just missed equaling 1929.

The greatest improvement during the year was shown in the heavier equipment. Transmission and distribution equipment, for instance, was up 39 per cent, generation apparatus 37 per cent, insulated wire and cable for light and power 35 per cent and industrial apparatus 29 per cent. A new peak was established in the production of industrial apparatus. The other heavy equipment, while still below the peak, gave evidence of a greatly enlarged utility construction budget.

Employment in the electrical manufacturing industry grew faster than production. It was up some 30 per cent over 1936 and exceeded the previous peak in 1929 by 7 per cent. Since the largest production gains were in capital goods, it is obvious that the electrical manufacturers can continue to contribute to employment recovery to the extent that utilities and industry can be relieved of the handicaps that make capital investment difficult.

General manufacturing production was only 6 per cent ahead of 1937, while electrical was 22½ per cent higher. The necessity, therefore, of encouraging the utilities to expand and replace obsolete equipment would seem obvious to any one truly interested in building up labor's spending power.

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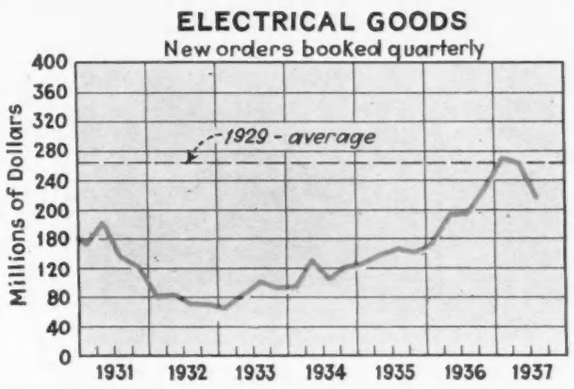
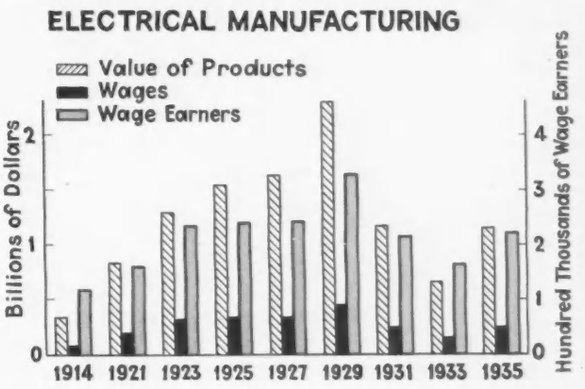


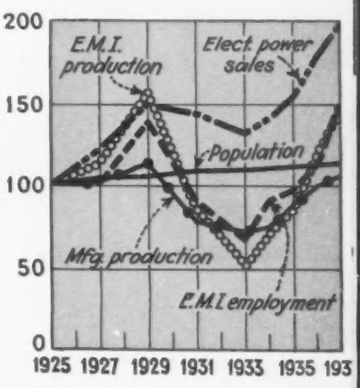


ELECTRICAL MANUFACTURING INDUSTRY AND RELATED FACTORS, 1925-1937

Index Numbers 1925 = 100

	1925	1927	1929	1931	1933	1934	1935	1936	1937†
1. E. M. I. production	100	112	156	85	51	70	85*	119*	146
2. E. M. I. employment	100	101	137	90	68	90	97	113*	147
3. Manufacturing industry production	100	101	113	76	71	74	86	100*	106
4. Electric power sales	100	122	150	144	131	141	155	180	199
5. Population	100	103	106	108	109	110	111	112	113

* Revised. † 1937 figures estimated by N.E.M.A. statistical department.



NOTES

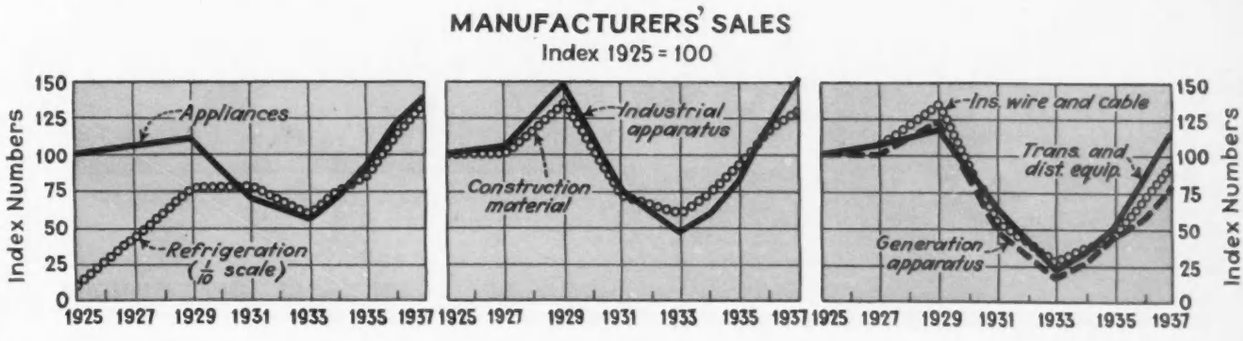
1. E.M.I. PRODUCTION based on U. S. Census of Manufactures and data compiled by N.E.M.A. statistical department. In addition to products shown in electrical machinery apparatus and supplies schedule of the Census are included electric refrigeration, radio apparatus and supplies, steam turbines for electrical drive — other than marine, electrical porcelain, glass insulators and electric washing machines.

2. E.M.I. EMPLOYMENT based on labor series of National Industrial Conference Board, but adjusted to 1925 = 100. This series represents the electrical manufacturing industry including radio.

3. MANUFACTURING INDUSTRY PRODUCTION based on the Federal Reserve Board's index for the manufacturing industry and adjusted to 1925 = 100.

4. ELECTRIC POWER SALES index figures for 1927-1937 based upon Edison Electric Institute data. 1925 and 1937 have been estimated by the N.E.M.A. statistical department.

5. POPULATION based upon the annual midyear estimates of the U. S. Bureau of the Census.



SOME MAJOR BRANCHES OF THE ELECTRICAL MANUFACTURING INDUSTRY, 1925–1937

Index Numbers 1925 = 100

	Manufacturers' Sales	1925	1927	1929	1931	1933	1934	1935	1936	1937†
1. Appliances	100 = $140,000,000	100	106*	110*	72*	57*	73*	92*	121*	139
2. Refrigeration	100 = 16,000,000	100	425	766	778	574	747	844*	1,131*	1,350
3. Construction material	100 = 38,000,000	100	100	135	71	59	74	93*	116*	131
4. Industrial apparatus	100 = 132,000,000	100	105	149	75	47	59*	83*	118*	152
5. Generation apparatus	100 = 37,000,000	100	100	123*	50*	18*	28*	46*	59*	81
6. Trans. and dist. equip.	100 = 180,000,000	100	106*	120*	64*	22	33*	50*	83*	115
7. Ins. wire and cable for light and power	100 = 110,000,000	100	106	133	54	27	36	46	69*	93

* Revised. † 1937 figures estimated by N.E.M.A. statistical department.

NOTES

1. APPLIANCES include domestic kitchen and table appliances, electric ranges, electric water heaters, electric vacuum cleaners, electric washing machines, electric fans and food service equipment.

2. HOUSEHOLD REFRIGERATION includes complete units, parts and cabinets. Commercial refrigeration equipment and air-conditioning equipment are excluded. These index figures appear unusually large because the household refrigeration industry was just beginning about 1925 and therefore the base figure is small.

3. CONSTRUCTION MATERIAL includes carbon, electrical porcelain, laminated phenolic products, manufactured electrical mica and vulcanized fiber. Molded insulation is excluded.

4. INDUSTRIAL APPARATUS includes electric welding equipment and wire, industrial controls, industrial heating equipment and motors and generators (excluding all generators except motor-generator sets). Electric furnaces and electric tools are excluded.

5. GENERATOR APPARATUS includes large generating and converting apparatus and steam turbines for electrical drive. (Also included are small generators which could not be separated from the large generator data).

6. TRANSMISSION AND DISTRIBUTION EQUIPMENT includes switchgear, capacitors, feeder voltage regulators, high-voltage insulators, power and distribution transformers, lightning arresters, pole line hardware and earth anchors, panelboards and distribution boards, small air circuit breakers and electrical measuring instruments.

7. INSULATED WIRE AND CABLE FOR LIGHT AND POWER includes wire and cable of various types of insulation such as paper, rubber, varnished cambric and weatherproof used primarily for lighting and power circuits and lines. Bare wire is excluded.

All indices based upon U. S. Census of Manufactures data and N.E.M.A. statistical department data corrected where possible to represent the entire industry.

Electrical

VALUE OF ELECTRICAL EXPORTS (Dollars)

Condensed from detailed tables issued by Electrical Division, Bureau of Foreign and Domestic Commerce, Department of Commerce

Item*	1934	1935	1936	9 Mos. 1937	9 Mos. 1936
Generators	1,070,903	1,341,028	1,627,369	1,464,951	1,194,732
Arc-welding sets	376,140	502,816	719,777	764,443	505,902
Self-contained lighting units	208,535	285,038	650,390	1,215,277	422,597
Starting, lighting and ignition	1,232,685	1,222,978	1,316,643	1,084,535	973,422
Transformers and converting apparatus	962,944	1,186,476	2,013,072	1,793,906	1,477,917
Transmission and distribution apparatus	1,253,723	1,896,610	2,156,519	2,048,861	1,599,973
Glass insulators	57,404	90,937	89,280	63,897	70,346
Electrical porcelain	455,642	502,407	541,170	554,481	402,790
Instruments	1,485,685	1,913,582	2,201,260	2,292,243	1,524,562
Motors	4,801,600	6,007,785	7,770,376	6,850,608	5,807,346
Electric refrigerators	13,570,884	15,303,312	19,171,400	16,665,014	15,423,252
Incandescent lamps	972,478	1,062,806	1,323,393	1,114,732	957,018
Globes and shades	217,730	270,757	337,783	281,137	241,918
Washing machines	332,722	553,800	1,116,433	1,517,137	742,164
Vacuum cleaners	229,756	333,679	806,838	653,338	592,188
Other domestic appliances	1,076,311	1,355,216	1,861,619	1,665,782	1,264,606
Flashlights, fans, floodlights, etc	1,010,715	1,176,727	1,426,383	1,373,671	1,708,804
Industrial furnaces	350,639	398,195	615,988	516,153	429,202
Therapeutic and X-ray apparatus	1,025,102	1,415,542	1,474,399	1,452,428	1,068,639
Radio apparatus	24,856,592	25,454,734	28,278,705	23,660,549	19,371,190
Telegraph apparatus	244,053	179,736	226,706	337,574	155,110
Telephone apparatus	1,219,818	1,922,544	2,027,496	2,333,779	1,493,773
Electric clocks	97,013	181,169	299,531	278,542	183,438
Batteries	3,985,844	4,307,203	4,902,429	5,059,038	3,626,558
All other electrical equipment	3,428,273	5,079,850	5,957,903	5,814,133	4,281,058
Insulated wire and cable	1,687,847	1,945,466	2,336,876	3,082,800	1,721,451
Conduit, wiring and fixtures	2,829,623	3,193,768	3,707,356	3,671,750	2,639,391
Nickel chrome wire	372,900	325,009	414,542	420,624	312,692
Carbon electrodes, brushes, etc	3,221,750	2,721,441	3,611,000	3,291,202	2,710,468
Total	72,635,311	82,130,611	98,982,636	91,322,585	72,902,507

* Short titles used. Values include parts.

DURING the past few years exports of electrical goods have increased steadily in value, and in 1936 they amounted to nearly $100,000,000, an increase of 36 per cent over 1934. Progress continued during 1937, the first nine months showing a gain of 25 per cent over the corresponding period a year ago.

It will be seen from the table that exports of radio

Status of Federal Power

PWA PROJECTS ENJOINED*

A Electric power projects with PWA allotments covered by injunctions against the administrator in courts in the District of Columbia.
B In federal courts outside of District of Columbia.
C Electric power projects in federal courts outside of District of Columbia; administrator not enjoined.

Group	No. of Projects	Allotments	Loans	Grants	Estimated Cost of Projects
		(Dollars)	(Dollars)	(Dollars)	(Dollars)
A	42	47,096,817	26,584,600	19,084,117	77,601,252
B	3	3,979,000	2,819,800	889,009	4,058,000
C	6	1,488,826	787,544	701,282	2,367,036
Total	51	52,564,643	30,191,944	20,674,408	84,026,288

* The decision of the Supreme Court of January 3 now permits these projects to go forward.

POWER projects now in hand by agencies of the federal government will have an ultimate capacity of 7,500,000 hp. and will cost $1,300,000,000. The former figure is about one-sixth of the aggregate rating of power plants of the entire electrical industry as it stands at present. Reference is here made only to major developments by the Bureau of Reclamation, the Tennessee Valley Authority and the Corps of Engineers. To these must be added the numerous PWA power pro-

TENNESSEE VALLEY AUTHORITY

Project	Power Installation		In Service December 31			Appropriation to Date (Dollars)	Initial Cost (Dollars)
	Initial (Hp.)	Ultimate (Hp.)	1936 (Hp.)	1937 (Hp.)	1938 (Hp.)		
Wilson Dam	261,400	612,800	261,400	261,400	261,400	.....	46,950,748
Norris Dam	132,000	132,000	132,000	132,000	132,000	.....	36,310,370
Wheeler Dam	90,000	360,000	45,000	90,000	90,000	.....	35,217,964
Pickwick Dam	96,000	288,000	0	0	96,000	.....	33,199,497
Guntersville	102,000	136,000	0	0	102,000	.....	34,123,660
Chickamauga	108,000	144,000	0	0	0	.....	40,435,645
Hiwassee	80,000	160,000	0	0	0	.....	17,000,000
Gilbertsville	Undetermined		0	0	0	.....	112,000,000
Total	869,400	1,832,800	438,400	483,400	681,400	*191,066,270	355,237,884

* TVA appropriations are not allocated to specific projects.

CORPS OF ENGINEERS

Project	Power Installation		In Service December 31			Appropriated to Date (Dollars)	Initial Cost (Dollars)	Ultimate Cost (Dollars)
	Initial (Kw.)	Ultimate (Kw.)	1936	1937	1938 (Kw.)			
Bonneville	86,000	430,000	0	0	86,000	51,248,700	51,000,000	70,000,000
Fort Peck	Undetermined	105,000	0	0	0	96,337,000	108,600,000	115,350,000
Total	86,000	535,000	0	0	86,000	147,585,700	159,600,000	185,350,000

NOTE—Passamaquoddy and Bluestone are indefinitely suspended, with no appropriations now available for construction purposes.

Exports

apparatus lead all other groups and constitute about 28 per cent of the total. Next come refrigerators, 19 per cent. This single item is approximately equal to the entire value of heavy equipment constituting the first ten items. It would appear from this that American power machinery is confronted by severe competition, whereas our conveniences enjoy world-wide acceptance.

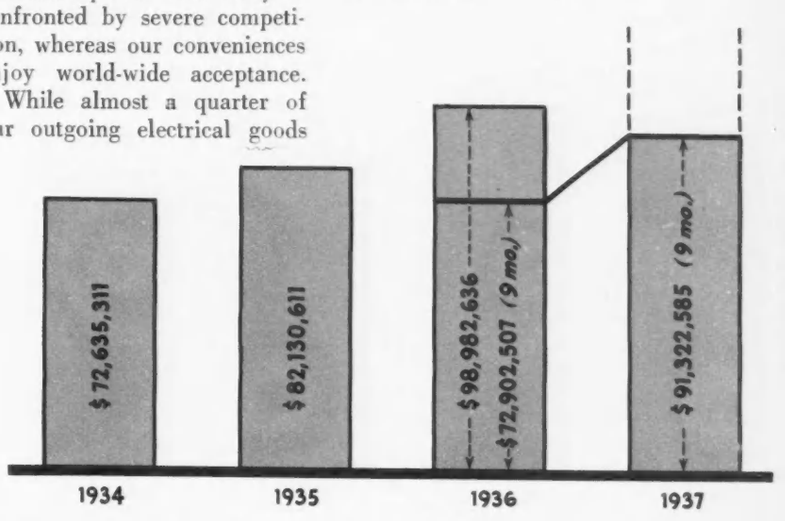
While almost a quarter of our outgoing electrical goods find their destination in our three immediately neighboring countries, distant South Africa takes more than Mexico.

The table of exports by commodities has been condensed from reports by the Electrical Division, Department of Commerce, giving quantities in detail for each country.

EXPORTS TO LEADING COUNTRIES

With Values in 1936

Canada	$14,408,074
United Kingdom	10,395,016
Union of South Africa	7,799,554
Mexico	5,946,717
Brazil	5,542,014
Argentina	4,632,939
France	3,304,834
Cuba	3,174,666
U.S.S.R. (Russia)	3,048,811



Projects

jects, to which $144,000,000 has been allotted. About 550,000 hp. of major projects are to go into operation in 1938.

P.W.A. POWER PROJECTS—SUMMARY, DECEMBER 1, 1937

Type	Allotments		Not Started	Started, Not Completed	Completed	Total in Litigation	In Litigation, but Started	In Litigation, Not Started
	Power Portion	No.						
New	$126,805,736	92	59	13	20	59	8	51
Additional	11,922,159	126	7	12	107	3	0	3
Transmission	2,952,445	8	1	1	6	0	0	0
Institution	2,448,598	53	2	15	36	0	0	0
	$144,128,938	279	69	41	169	62	8	54

BUREAU OF RECLAMATION

Project	Power Installation		In Service December 31			Appropriated to Date	Initial Cost	Ultimate Cost
	Initial	Ultimate	1936	1937	1938			
	(Hp.)	(Hp.)	(Hp.)	(Hp.)	(Hp.)	(Dollars)	(Dollars)	(Dollars)
Boulder Dam	515,000	1,835,000	400,000	515,000	745,000	PWA: 38,000,000 App.: 75,810,000	126,500,000	[1]165,000,000
All-American Canal		(Power development by Imperial Irrigation District, El Centro, California)						
Grand Coulee	478,000	2,700,000	0	0	0	PWA: 15,000,000 19,800,000 App.: 20,750,000 13,000,000	186,000,000	[2]394,500,000
Kendrick (Seminoe)	30,000	45,000	0	0	0	PWA: 6,980,000 ERA:* 5,227,000 App.: 1,650,000	20,000,000	[3]20,000,000
Central Valley	375,000	470,000	0	0	0	ERA:* 4,200,000 App.: 19,400,000	170,000,000	[4]170,000,000
Colorado — Big Thompson	40,000	190,000	0	0	0	App.: 900,000	Irrig.: 24,666,079 Power: 7,036,693	Irrig.: 24,666,079 Power: 19,083,243
Totals	1,438,000	5,240,000	400,000	515,000	745,000	App.: 131,510,00 PWA, ERA: 89,207,000	534,202,772	793,249,322

[1] Includes all-American Canal. [2] For dam and irrigation development.
[3] Includes Alcova dam and irrigation system.
[4] Includes whole project, while Shasta dam alone will have power development.
* ERA — Emergency Relief Appropriations.

OUTSTANDING FACTS

Figures are on electric light and power industry for the year's operations or as of the end of each year

	1930	1931	1932	1933	1934	1935	1936	1937*
CAPITAL invested ($1,000)	11,800,000	12,400,000	12,600,000	12,800,000	12,900,000	13,100,000	13,400,000	13,800,000
Securities issued ($1,000)[3]	1,587,853	1,508,242	470,257	56,248	131,175	1,067,671	1,331,940	646,312
Securities ex w. & r. ($1,000)[2]	1,297,535	1,182,904	404,840	53,725	131,175	1,067,671	1,331,940	645,682
New cap. ($1,000)	894,473	424,163	165,728	6,813	2,431	26,496	59,727	81,983
Refunding ($1,000)	403,062	758,741	239,112	46,912	128,744	1,041,175	1,272,213	563,698
REVENUE elec. serv. ($1,000)	2,151,150	2,125,111	1,961,111	1,887,260	1,975,285	2,064,753	2,208,087	2,376,000
From ult. consumers ($1,000)	1,990,955	1,975,945	1,813,717	1,754,566	1,831,871	1,911,989	2,044,587	2,200,000
Farm ($1,000)	46,690	50,727	47,128	46,502	49,183	48,405	59,286	67,400
Residential ($1,000)	642,276	653,283	640,385	623,797	648,802	673,526	696,997	740,100
Small lt. and pwr. ($1,000)	575,598	564,524	500,993	471,781	490,420	519,213	562,122	628,600
Large pwr. and lt. ($1,000)	566,468	544,729	474,425	468,390	499,452	531,107	581,149	618,260
Other consumers ($1,000)	159,922	162,681	150,786	144,096	144,013	139,737	145,032	145,640
Other sources ($1,000)	160,195	149,166	147,394	132,694	143,414	152,764	163,500	176,000
EXPENDITURES								
Additions, extensions ($1,000)	960,890	596,740	285,000	129,300	147,654	192,855	289,710	455,480
Operating, total ($1,000)	946,180	913,910	817,950	795,811	857,200	867,450	937,500	1,028,000
Salaries and wages ($1,000)	423,000	392,000	323,880	292,000	316,000	330,000	360,000	397,500
PRIVATE COMPANIES								
Oper. Revenue [1] ($1,000)	.....	.....	1,719,000	1,664,000	1,736,000	1,813,000	1,941,000	2,086,000
Oper. exp.[1] ($1,000)	.....	.....	602,000	579,000	623,000	660,000	723,000	794,000
Taxes ($1,000)	.....	.....	205,000	215,000	243,000	255,000	285,000	307,000
ENERGY (1,000,000 kw.-hr.)								
Generated	88,592	85,575	76,714	78,933	84,986	92,612	106,566	114,200
From fuel	59,387	58,038	45,913	47,576	53,917	56,068	69,336	73,900
From water power	29,205	27,537	30,801	31,357	31,069	36,544	37,230	40,300
Total, incl. imported and purch.	91,957	88,401	79,692	89,411	88,353	95,864	109,685	119,000
RATINGS								
Generator rating (kw.)	32,049,919	33,076,906	33,864,072	33,733,620	33,524,471	33,888,305	34,260,071	35,042,000
Steam (kw.)	23,427,058	23,823,017	24,358,777	24,165,698	23,780,148	23,989,227	24,106,618	24,745,000
Water power (kw.)	8,046,732	8,806,096	8,922,969	8,974,887	9,140,690	9,288,537	9,538,640	9,617,000
Int. combust. eng. (kw.)	416,129	447,793	582,326	593,035	603,633	610,541	614,813	680,000
FUEL CONSUMPTION								
Coal and coke (1,000 short tons)	39,702	35,690	27,589	28,039	30,942	32,243	39,535	42,398
Oil (1,000 bbl.)	8,950	7,899	7,269	9,446	10,076	11,112	13,926	14,545
Gas (billion cu. ft.)	119	138	107	101	125	121	150	162
ENERGY SALES								
Ult. consumers (mil. kw.-hr.)	74,906	71,902	63,711	65,916	71,082	77,596	90,044	99,300
Farm	1,789	1,879	1,579	1,633	1,857	1,692	2,138	2,660
Residential	10,703	11,373	11,494	11,359	12,233	13,496	14,992	16,930
Small light and power	13,944	13,544	12,106	11,589	12,278	13,588	15,612	18,410
Large power and light	40,148	36,937	30,964	33,857	36,944	40,865	48,655	52,640
Other	8,322	8,169	7,568	7,478	7,770	7,955	8,647	8,660
CUSTOMERS								
Total number (1,000)	24,556	24,490	23,878	24,027	24,663	25,313	26,206	27,000
Farm	650	699	709	713	744	789	1,043	1,200
Residential	19,880	19,658	19,140	19,301	19,866	20,446	20,988	21,600
Small light and power	3,626	3,724	3,604	3,621	3,670	3,711	3,825	3,865
Large power and light	347	348	371	335	324	305	280	265
Other	53	61	54	57	59	62	70	70
People in electric lighted homes	83,400,000	82,700,000	82,500,000	82,500,000	84,500,000	87,000,000	90,000,000	93,500,000
Per cent of total population	68.2	67.4	67.0	66.7	67.1	68.5	70.3	72.3
EMPLOYEES, total	298,000	282,000	244,573	232,000	247,000	248,000	264,000	277,500

* Estimated, generally on ten months' operations.
[1] Intercompany transactions eliminated.
[2] Does not include warrants and rights.
[3] Includes warrants and rights.

★ CHRONOLOGY of 1937 ★

JANUARY

Fire damages Essex plant of New Jersey Public Service Electric & Gas.

Utilities P. L. files voluntary 77-B proceedings.

PWA reports $18,835,901 for power plant allotments.

Alex Dow awarded Edison medal.

Oregon Planning Board survey opposes equal rate plan for Bonneville power.

Pennsylvania Joint Committee disbands, passes work to farm and electric utility organizations.

FTC orders manufacturers to cease uniform price practices.

Congress asked to appropriate $43,000,000 for TVA.

House Committee attacks failure of government power policy.

Judge Mack dismisses 77-B reorganization proceedings against Associated Gas & Electric.

President names Federal Power Policy group.

TVA Chairman Morgan pleads cooperation with utilities.

Power officials form "grid" to aid utilities in flood districts.

President shelves TVA power pool plan, calls off conferences.

Injunction against Nebraska "Little TVA" projects granted.

Judge Mack upholds Utility Act; Electric Bond & Share must register.

FEBRUARY

TVA declines four-point power program submitted by Willkie.

Duke Power gets temporary restraining order on Buzzard Roost project.

J. D. Ross proposes purchase of Puget Sound Power & Light by Seattle.

North American and American Water Works withdraws suits against Utility Act, to register.

Morris L. Cooke succeeded by John M. Carmody as REA administrator.

Ontario Commission and Ottawa Valley Power settle contractural difficulties.

Alabama Power sells Tuscumbia distribution system to city, to use TVA power.

Arc Welding Foundation announces $200,000 contest.

Niagara Hudson proposes consolidation of 14 operating companies.

Philadelphia Electric files $130,000,000 registration statement with SEC.

MARCH

Flood of anti-merchandising bills.

Commonwealth Edison enters electric range field with dealer cooperation plan.

Roosevelt recommends provisional authority to operate Bonneville.

San Francisco and Fresno, Calif., voters turn down municipal ownership.

Regional planning 7-TVA bill introduced in Senate.

Hearings start on suit to block PWA financing for Santee-Cooper project.

Professor Elihu Thomson dies.

Harrison nominated as A.I.E.E. president.

TVA given free hand to sell electricity in Georgia by Circuit Court of Appeals.

Ralph Tapscott elected president New York Consolidated Edison, succeeding Frank W. Smith.

American Light & Traction files with SEC under utility act.

Country newspaper editors survey opposes Federal power projects.

APRIL

Fourth Annual Sales Conference of E.E.I. in Chicago.

San Diego voters turn down municipal ownership.

Tennessee Supreme Court over-rules Memphis Power & Light and Tennessee Electric upholds state act authorizing municipal system at Chattanooga, and Memphis contract with PWA for sale of bonds to finance plant; both to take TVA power.

Pennsylvania's Republican Public Service Commission abolished.

Utility representatives oppose appliance sales ban proposal in Connecticut.

Philadelphia's 66,000-volt transmission line shorts.

U. S. Supreme Court denies application of Georgia Power to stay Judge Underwood's order forbidding company to enforce, in Georgia, Federal Judge Gore's injunction enjoining TVA from expanding activities.

SEC lifts Maine's ban against exporting hydro-electric energy.

FTC orders manufacturer's price fixing agreements on turbines and condensers to desist.

Boston Edison plans first major increase in capacity in eight years.

Vermont Senate turns down municipal ownership in three cities.

TVA asks for $48,500,000 to carry program through July 1, 1938.

Rocky Mountain Electrical League formed.

Alabama Power enjoined from joining other utilities in suit against TVA.

Tennessee Electric Power plans new 25,000-kw. Nashville steam plant.

Westinghouse and General Electric report orders booked during first quarter are highest on record.

MAY

New Jersey Supreme Court voids Camden power plant referendum.

SEC member Healy tells savings banks group Utility Act contains no threat to destroy utility industry.

FPC approves 96,500-hp. Nebraska Platte project.

Niagara-Hudson "Five-Star" homes get under way.

Carlisle says Niagara-Hudson to spend $100,000,000 in next five years.

Iowa Light & Power and Alabama Power PWA suits dismissed.

Edward F. Barrett named president to succeed Phillips, who becomes chairman of Long Island Lighting.

Brookings Institute recommends centralization of Federal power activities.

New York Consolidated Edison and I.B.E.W. agree on collective bargaining.

REA organizes Washington staff to aid co-operative managers.

JUNE

Supreme Court denies Electric Bond & Share Utility Act review certiorari.

REA co-operative at Bartlett, Texas, forced to raise rates.

N. Y. Public Service Commission prescribes new account system.

E.E.I. annual convention in Chicago.

President Kellogg re-elected to head E.E.I.

Roosevelt asks legislation for creation of "7-TVA's."

Employees of Consumers Power strike, restore service on order of Governor.

Judge Glenn rules PWA loan and grant for Buzzard Roost legal.

New York Commission orders municipal plants to reduce rates.

Pennsylvania's new commission notifies utilities to make sweeping rate reductions.

New York completes plan for unemployment tax on utility income.

Consumers Power signs with C.I.O. following strike.

Duke Power granted temporary injunction against Buzzard Roost construction.

John B. Blandford, Jr., appointed general manager of TVA.

JULY

Arkansas Power signs contract for surplus TVA power.

Massachusetts commission kills proposed Tri-County rural project.

Ontario government settling claims between province, Hydro Commission and Abitibi Power.

Colonel Hugh L. Cooper dies.

Connecticut Anti-merchandising bill killed in committee.

New York municipal plants cut rates.

TVA signs new contract with Aluminum Company.

Wisconsin's Governor signs measure giving state "Little TVA."

Toledo Edison recognizes A.F. of L. group.

P.G. & E. employees form own organization for collective bargaining.

Commercial Electric Cooking Council organized.

Middle West Corp. passes out of federal court control.

American Gas & Electric plans 2,400-lb. station.

National Resources Committee study shows advantage of steam over hydro.

AUGUST

The 237-mile, 230-kv. Boulder Dam line completed.

Wisconsin's Secretary of State refuses to release Wisconsin Development authority ("little TVA") funds.

PWA gives $118,000 advance to Buzzard Roost project.

FPC authorizes construction by Seattle of Ruby dam.

Lightning strikes partly completed Edison Memorial Tower.

Tennessee Commission grants Tennessee Electric Power permission to build Nashville steam plant.

FPC prescribes uniform system of accounts for Class A and B utilities.

Electrical Association of New York admits gas interests.

American Water Works & Electric becomes first large holding company to comply with "death sentence" in filing for simplification of system with SEC.

Westinghouse completes purchase of A.B.See Elevator Company.

All-time high in monthly output history —10,099,000,000 kw.-hr. recorded for August.

SEPTEMBER

All-time peak in power output hit in week of September 4—2,320,982,000 kw.-hr.

PWA approves $29,863,473 loans and grants for power projects; $20,000,000 goes to Nebraska.

Tennessee Electric Power signs interconnection and standby contract with TVA.

E.E.I. survey shows 20 per cent of farmers near lines do not take service.

National Association of Railroad and Utilities Commissioners warns against mounting tax burden on utilities.

Federal Judge Glenn upholds Santee-Cooper Hydro power plant.

General Electric announces "Electrical Standard of Living" plan.

Duke Power asks Supreme Court to halt Buzzard Roost loan and grant.

Wisconsin Development Authority held legal by Circuit Court.

Wheeler Dam opened at TVA dedication.

Governor Aiken of Vermont attacks Federal power policies.

PWA allots $20,000,000 for Oklahoma power dam on Grand River.

FPC announces inquiry into interlocking directorates.

TVA revenue totals $1,650,000 for fiscal year ended July 1.

OCTOBER

President starts first generator of Bonneville project.

Alabama Power files suit against REA loan to Cherokee County cooperative.

U. S. Chamber of Commerce sees waste in regional planning bill.

Purcell L. Smith named chairman Middle West board; D. C. Green resigns as president.

Frank R. McNinch in temporary shift from FPC to chairman F.C.C.

Sacramento Municipal Utility District asks FPC approval of 201,000-hp. hydro project on Silver Creek and American River.

SEC Commissioner Ross named administrator of Bonneville.

Drastic drop in security prices clouds new financing prospects.

West Penn Power announces plans to discontinue merchandising.

Annual N.E.M.A. convention at Chicago.

C. E. Swatzbaugh gets McGraw award for manufacturers.

McGraw Contractor-Dealer award goes to George W. Patterson.

NOVEMBER

Pennsylvania, Kentucky and Virginia voters defeat municipal ownership.

Chicago utilities quit E.E.I.

Roosevelt approves Ross government power rate formula.

Committee of Utility Executives traces $2,600,000,000 utility construction lag to government "punitive" policy.

SEC adopts new form for annual report of holding companies.

Court of Appeals upholds Judge Mack's ruling requiring registration of Electric Bond & Share.

Voters defeat plans to put Pacific Gas & Electric out of business in Redwood City.

Wisconsin Utilities Association submits power survey to PSC.

Alabama Power reports cut in 1938 construction budget due to Federal policies.

TVA constitutionality suit opens in Chattanooga.

FPC orders investigation of Safe Harbor Water Power rates.

Willkie meets with President Roosevelt in first conference of utility executives.

Carlisle talks with President, promises $100,000,000 construction in next two years.

FPC rules license needed for Aluminum Company dam on Yadkin River.

Duke Power files brief with Supreme Court attacking PWA loans to Buzzard Roost.

Stone & Webster to distribute holdings in utility companies.

DECEMBER

Willkie memorandum to President for co-operation with utilities released.

McGraw Award for cooperation goes to E. A. Brand.

Roosevelt advocates prudent investment for rate making.

Earle S. Thompson named president of American Water Works & Electric to succeed H. Hobart Porter who becomes chairman.

Pennsylvania Power & Light standby plant gets "emergency test" on unprecedented PSC order.

Alabama Power and Cherokee County REA cooperative settle dispute.

Electric Bond & Share argue utility act before Supreme Court.

Pacific Gas & Electric employees vote for independent organization.

Canada's Premier Hepburn says U. S. blocks export of surplus electric power.

D. C. Barnes named head of Engineers Public Service.

Mountain States Power files voluntary 77-B proceedings.

An AUDIT of 1937 Electric Utility Business

By C. W. KELLOGG
President Edison Electric Institute

To the Members of the Electric Utility Industry:

I AM GLAD to take advantage of the invitation of the ELECTRICAL WORLD to use its columns to make a few comments on the state of the industry at the end of 1937. The figures for 1937 are based on ten months actual and two months estimated, but are probably substantially correct.

In spite of the business recession which marked the end of the year, 1937 set a new high record for electric energy output of about 119,000,000,000 kw.-hr., a gain of 8½ per cent over the previous year and of 28 per cent over the pre-depression year of 1929. The sources of this energy were divided about as in former years—58 per cent by fuel, 38 per cent by water power and 4 per cent purchased and other.

At the end of the year generating capacity (which was 27½ per cent hydro) was approximately 35,042,000 kw., a net gain of 782,000 kw. during the year and a gain over 1929 of 5,483,000 kw., showing that the utilities were anything but inactive with construction during the depression.

Construction expenditures

Total construction expenditures (exclusive of federal work) were about $455,500,000, compared to about $290,000,000 in the previous year. Construction expenditures in 1937 were, however, less than one-half what they were in the peak year of 1930. As has been the case for many years, only 27 per cent of construction costs were for generating capacity, the remainder representing facilities for distributing energy from the generating station to the consumers' premises.

The total number of consumers at the year-end was approximately 27,000,000, an increase of 794,000 during the year. As 22,440,000, or 83 per cent, of the total consumers are residences (including farms), they represent far the largest human element in the picture. It is therefore of particular interest to outline the progress of residence consumption and rates.

The average residential use of electricity was 797 kw.-hr. in 1937, compared with 727 in 1936, and the average kilowatt-hour price 4.37 cents at the year-end compared with 4.65 cents in 1936. These figures do not include farms, but their inclusion makes a combined average for 1937 of 805 kw.-hr. and 4.38 cents respectively.

It is interesting in this connection to consider what the electric industry has accomplished for the home user of electricity in the decade now ending. It was in the beginning of this period that the utilities conceived and began to put into effect the inducement rates, now well-nigh universal in the industry, whereby average rates for the home are reduced as individual home consumption increases. In 1926 the average residence consumed 428 kw.-hr. and paid for them an average price of 6.98 cents. In 1937 the average consumption was 797 kw.-hr. and the average rate 4.37 cents per kilowatt-hour. The increase of 86 per cent in the use of electricity in nearly 23,000,000 homes means incalculable gains to an even larger number in comfort, health, convenience and saving of human labor. The decrease of 2.61 cents, or more than 37 per cent, in average rate during this period, in an industry where five-eighths of the costs are fixed, and which corresponds to $441,000,000 annual saving at the present rate of consumption, represents a contribution to the commonweal which our managements and sales forces can contemplate with deep pride and satisfaction.

Farm electrification

Getting electricity to the farms of our country has been the object of special effort and study by the electric utility industry for more than fifteen years. From the start the difficulties connected with this effort have been those inevitably following from the high cost of disribution lines per farm where settlement was sparse and from the relatively low cash purchasing power of the majority of farmers. These difficulties have, how-

ever, acted as a spur to continued effort to solve them and further notable progress has been made during the year 1937. The number of farms now electrified is about 1,200,000, of which about 157,000 were added to the list during the past year. In addition, it is estimated that about 280,000 farms can be reached by exising farm lines. This makes electricity available to about 1,480,000 farms, a number equal to about 35 per cent of all the farms in the country having dwellings valued at $500 or over. As indicating the continued activity of the utilities in farm electrification, it is worth noting that more than 85 per cent of the new farms connected in 1937 were to the lines of private companies.

Appliance sales co-operation

It is recognized that the growth of use of electricity in the home is almost entirely from the additional electrical equipment installed there. In the sale of electrical appliances also 1937 was a record year, the total sales of the three major appliances in that and the preceding year showing:

	1937	1936
Refrigerators	2,400,000	2,080,000
Ranges	415,000	320,000
Water heaters	110,000	92,000

In the five years ending with 1937 electric refrigerator sales have totaled 8,500,000.

In this connection comment should be made on the extent to which the electrical dealers and other retailers have carried out this great program. The best statistical data show that the utilities themselves sold but 15 per cent of the total volume of household electrical appliances. It is the proper function of the utilities to pioneer in the promotion of sales of new products with relatively low saturation, so that they still sell the majority of ranges and water heaters, but there is a striking increase in the percentage of even this business done by the dealer and retailer. In all selling there is close co-operation between utility and dealer.

This same co-operation is evident in the numerous promotional programs organized nationally between Edison Electric Institute and manufacturers of electrical products. The refrigerator, range, water heater and small appliance groups join with us in the promotion of the modern electric kitchen, electric table cookery and commercial cooking devices; the lamp manufacturers and the utilities jointly promote Better Light-Better Sight, and the pump manufacturers advance with us the use of running water on farms.

Earnings

While energy output in 1937 was up 28 per cent over 1929, gross revenue was but 10 per cent better than the year 1930, the pre-depression peak, the difference representing decrease in average rates. The relative size of net earnings was even less encouraging due to the rise in unit costs since 1929. Taxas, which are now 15 per cent of gross revenue, have increased about 50 per cent since 1929 and the unit cost of labor per man-hour (labor forming more than half the operating expenses) has increased 35 per cent even since 1933. The notable rate reductions of the last ten years have been predicated on the theory that, five-eighths of the total costs being relatively fixed, they form a constantly smaller amount per unit of output as the latter is increased. This all supposes relative stability in other unit costs, but the sharply rising tendency in these other costs in recent years makes further rate reductions a threat to the financial stability of the industry.

Outlook for 1938

Based on past experience of the electric utilities, the sale of electricity for domestic use should continue to increase during 1938. It is interesting to recall in this connection that this class of electric business continued to grow in 1930 and 1931, contrary to the drop of 33 per cent in the business index during that period, and even in the bottom of the depression in 1933 domestic earnings were above 1929. Sales for commercial and industrial uses will depend more upon business activity, although these also have in the past shown much less drop during a depression than the general business index.

The volume of new construction in the coming year is also dependent upon the growth of business, for, of course, the only purpose of plant extension is to take care of the growth of power requirements. New construction has to be financed and, except for approximately $300,000,000 from retirement and amortization, the funds for construction have to be raised by the sale of securities. In this essential to the life and health of the utilities federal government competition and statute hang like a threatening cloud over the situation, deterring investment.

The electric utilities up to now have kept their financial house in order, holding their bonded debt down to about half of their total capitalization. This most desirable condition, which accounts for the high investment standing of our bonds, has been attained and can be maintained only by raising half the new capital by the sale of stocks, preferred and common. The preferred stock in turn is not salable without an adequate margin of security from the sale of common stock. It is clear, therefore, that the common stock money is the one final and necessary foundation that makes the whole structure stand up, and yet it is this very source of investment funds which is scared off by government policy and enactment. The continuation of this attack and repression can only lead in the end to the excessive debt issues that have brought the railroads of our country into such dire straits.

It is very much to be hoped that during the coming year the government, while continuing to regulate against any abuses by the utilities, will relax its attacks and repression, so that the utilities may be free to carry on effectively and efficiently their sole function of furnishing to the greatest possible number of citizens continually greater amounts of the best and most economical service.

Factors Affecting 1938 Electrical Manufacturing Business

By D. HAYES MURPHY
President
National Electrical Manufacturers Association

UPON receiving a request from ELECTRICAL WORLD for a summary of electrical manufacfacturing for the year, and a look forward into the new year, I wrote the members of the N.E.M.A. board of governors asking each one of them to let me know what the picture looked like from where he sat. The responses have been prompt, interesting and tremendously helpful, and I am very grateful for them. The N.E.M.A. board is a good cross-section of the electrical manufacturing industry, being composed of executives of large, medium-sized and small companies located in every industrial state in the Union, making all sorts and varieties of electrical products from the heaviest generating equipment down through innumerable types and sizes of apparatus and supplies, devices and appliances, to the finest and most delicate instruments, along with wiring materials of all kinds.

As I read over these fine letters I was reminded of a conversation which took place between two of our members at the December meeting of the board:

Mr. A.—"How's business?" Mr. B.—"Terrible!"

Mr. A.—"Well, how does it compare with last year?"

Mr. B.—"Oh, wonderful!"

It seems that 1937 was on the whole an exceptionally good year, with volume running from 10 per cent to as much as 30 per cent ahead of 1936, and production of some companies approaching that of 1929. Prominent among the factors contributing to this upward surge was the early-in-the-year fear of a shortage of raw materials and manufactured goods due to actual and threatened labor disputes. This caused a rush to cover and a piling up of inventories that proved burdensome when the reaction set in during the latter part of the year. While many merchandising and light construction lines under this somewhat overstimulated demand reached peak activity early in the year, the capital goods divisions of the industry hardly had a chance to gather momentum before the buyer's market of the first six months had changed into a seller's market, with volume receding at a rate the rapidity of which had never before been experienced. This recession, coupled with increased labor rates, higher material costs and other expenses, increased the difficulties of operating at a profit as the year drew to a close.

As to the current situation, business to some seems still to be headed steeply downward, with orders now being received at a rate only equivalent to that of 1934 or 1935. There is some feeling that the industry may be in for six or nine months of hard sledding. These views, however, seem to be based upon the possibility of unfavorable legislation and the uncertainties of the tax situation, rather than upon natural economic considerations. And, of course, it must be remembered that December is a month in which manufacturers who do not make items which can be hung on or placed under a Christmas tree are inclined to feel a bit low.

Recession may have run its course

On the other hand, with present reduced prices, and prospects of existing excessive inventories being liquidated in an orderly manner and the expected increasing consumption gradually overtaking the present reduced rate of production, there are indications that the recession may already have run its course.

In regard to the future, there is more than the usual amount of hesitancy about making predictions, and this is because of the realization that political tendencies and attitudes play so large a part in business sentiment as to make forecasting on the usual broad basis uncommonly hazardous. There is a feeling so many things can happen that it is wise to qualify even the most intelligent guess. However, the future has ever been a mystery, and perhaps it is no more so now than in the past.

The general expectation seems to be that production in 1938 will not equal that of 1937, but that it may not fall far short, especially if remedial measures now under consideration are put into effect by Congress and the Administration. The sooner such measures are taken the sooner confidence will be restored, and the earlier and more substantial the recovery should

be. Repeal or modification of the undistributed surplus tax would probably work wonders by encouraging plant improvement and expansion. A balanced budget and legislation changes calculated to dispense even-handed justice to employer and employee alike are frequently mentioned as two things that would be helpful.

Thus, while low volume coupled with higher labor and material costs indicate low profits during the first quarter, or possibly the first half of 1938, the thought seems to be pretty general that fundamental conditions are such that the pent-up demand will assert itself before the year is over and that 1938 as a whole may turn out pretty well. It seems clear that the electrical manufacturing industry is tough enough and resourceful enough to survive any number of individual blows at specific situations, and wise enough to join wholeheartedly in all sound movements to correct conditions which may not be in the best interests of the public so long as it feels that the actual foundations and basic premises of the system of private enterprise as a whole are not being cut from under that system. With less of business blaming government and less of government blaming business, and more of a recognition that both are up against problems which can be solved only by mutual respect and confidence, it becomes easier to look into the future fearlessly and with the assurance that everything must turn out right. When everything finally does turn out right and this nation is again enjoying full prosperity we must face again the test of self-control *en masse.*

Excesses must be restrained

Will business leaders be able to restrain themselves from excessive price advances? Will labor leaders be able to restrain themselves from excessive and misdirected demands? Will speculators be able to restrain themselves from excessive inflation of markets? The answer to all three questions should not be "NO," as it always has been in the past. It will be possible to make our next period of prosperity a very long one by keeping these destructive influences within the bounds of a greater, more co-operative control than in the past. Fortunately, leaders, both of labor and of industry, have been coming to a realization of the great responsibilities that must go with power when the public is to be served.

From the viewpoint of electrical manufacturers, business would be greatly benefited by a more liberal attitude of government toward utilities, and the hope is expressed that a way will be found to bring this about without in the least weakening any of the safeguards designed to protect the public against practices which have proved undesirable.

The long-established practice of utilities has been to provide themselves with equipment for generating, transmitting and distributing electricity well in advance of actual needs, and so long as this policy was in effect it tended to keep the rate of production of such equipment at relatively normal levels. During recent years, however, due to uncertainty as to the attitude of government and the resultant lack of confidence on the part of the security-buying public, utilities have been conserving cash resources and getting along with their present plants and equipment, buying only as needed, with the result that generators and transmission lines are running closer to capacity and in some cases are overloaded, running hot, so to speak.

Consummation of a satisfactory, workable understanding between government and untilities would break the log jam, first, by giving the utilities the courage to start immediately on a program of equipping their systems for present and future needs and, second, by providing the public with confidence to purchase the securities for financing the movement.

Capital goods the keystone

There is nothing simple about this industrial civilization of ours, but it is a fact that the production of capital goods items has always fluctuated more widely than the production of consumer goods, and that the difference between good business and poor business is largely a matter of rate of production of capital goods. Equipment for the generation, transmission and distribution of electricity is definitely in the capital goods class and is a large item in that class. The stage truly does seem to be set for action on a big scale, awaiting only a signal that government and utilities have reached a definite understanding. As soon as that signal is given private enterprise should immediately come to life, taking up much of the employment load which government now finds it necessary to carry.

Not only in lighting, but in all other uses of electricity, the demand is increasing as rapidly as the public can be educated to the conveniences and economies of electrical service. This educational work will be tremendously more effective from this time on, as the different branches of our industry have only recently learned how to work out and administer joint programs designed to acquaint the public with the undreamed-of benefits and enjoyment, the relief from drudgery and the economies to be derived from a generous use of electricity.

While there have been a number of successful campaigns for the sale of various electrical appliances during the past few years, it was not until comparatively recently that the entire electrical industry, with all branches represented, joined hands in an organized attack on the wiring problem—the neck of the bottle.

The sponsors of this undertaking are the following organizations: Artistic Lighting Equipment Association, Edison Electric Institute, Illuminating Engineering Society, International Association of Electrical Inspectors, National Electrical Contractors Association, National Electrical Manufacturers Association, National Electrical Wholesalers Association, Radio Manufacturers Association, and their work is recorded in the "Handbook of Interior Wiring Design."

This is the beginning of an organized movement

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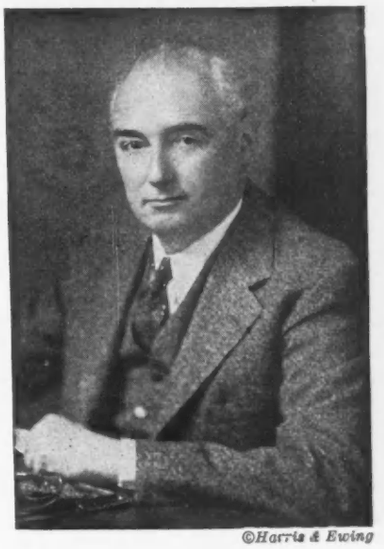
Jackson's Political Status

By CARTER FIELD



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This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him

FOR President in 1940—Robert H. Jackson! That's the latest word from the White House. That's the real meaning of Jackson's modest announcement in New York that he would accept the nomination for governor of the Empire State if the New York Democrats really wanted him!

Of course June, 1940, when the national conventions will pick their candidates for President, is a long time away. Much can happen. The betting of shrewd Washington observers is still that when the time comes Roosevelt will hear a call for him to continue his leadership that will be so compelling he will not be able to resist it. In fact, they will give you chapter and verse about who is going to organize the "call." But that's another story. The important thing at the moment is that we now see clearly the type of man the President wants as his successor.

So that it is a fair calculation, a pretty sound horseback opinion, that the White House program is for this country to get four more years of Roosevelt, beginning in 1941, or four more years of his policies, as carried out by a Jackson or somebody like him.

Moreover, at this moment, with his tongue in his cheek, Roosevelt *wants* the country to think of Jackson, the champion business baiter of them all, as his probable successor! No one has ever accused FDR of being stupid, whatever else they may say about him—certainly not stupid politically. So when the word was allowed to leak out from the White House itself that the President and a group of his advisers had agreed that Jackson was the best available man for the Democratic nomination for governor of New York this fall, no one could possibly think that Roosevelt had overlooked the certainty that any man elected governor of New York is a potential presidential nominee. If the President had wanted every one in the country to think he wanted Jackson as his successor, he could not have accomplished it more forcefully without actually saying so.

This is really the President's answer to the Southern conservatives, who have been plotting these many months to gain control of the party, against the day when Roosevelt's successor shall be named. It will make their road a good deal rougher.

The whole thing is enormously interesting, however distressing, to any conservative business man or investor. For instance, why did the President decide on Jackson, when he knew perfectly well that James A. Farley's lifelong ambition is to be governor of New York? Farley, who had served Roosevelt as no political lieutenant since Mark Hanna has served his chief!

Because Roosevelt is not *sure* Farley could be elected President! Or even nominated! FDR is not underestimating the Southern conservatives. Farley, most political leaders here think, could be elected governor of New York hands down. They think, if there were a primary, he could beat Jackson two to one, largely because of his close friendship with the leaders of the machine he himself built in every county from the Canadian line to Long Island.

Al Smith was elected governor of New York four times. But at the height of his popularity he didn't carry his own state for President, and for the same reasons that *might* pull Farley down in the big race. Religion, Tammany, lack of aristocratic background, which last, make no mistake about it, looms very largely in FDR's mind, however he may *seem* to indicate the contrary.

There is another dreadful thought. Farley is not a New Dealer at heart. He is just a magnificent political organizer and friend maker. He is a general making war without bothering what the causes of the war were, or what the consequences will be, because his government sends him. In his few non-political moments he is a shrewd business man. And of course there is always the possibility that "my policies" might be forgotten after Jim reached the White House. FDR knows all about the other Roosevelt picking Taft! Jackson is a knight errant in his own right. He sees the ogres of privilege clearly as they attempt to hide in the windmills.

But what about the Republicans? Are they utterly hopeless? We will get a good look into that situation this year. Let's consider it a second. Any schoolboy can take an electoral vote table, count up the South, and see that while the Democrats can win an election without New York, the Republicans can *not*. Also, New York is one of the states which is heavily penalized, under the New Deal, in being taxed to support what Joe Grundy stigmatized as the "backward states."

Assuming that the President does not change his mind, and has his way, and that Jackson is nominated for governor this fall, it would seem that if there is any virtue in the Republican party at all, it ought to be able to go places in a fight against

[*Continued on page 190*]

Editorials

S. B. WILLIAMS, Editor

Court Ruling Clarifies Competitive Position

THE decision of the Supreme Court upholding the right of municipalities through PWA loans and grants to build plants and distribution systems and to compete with privately owned utilities was a blow to the electric utility industry. Nevertheless, it has cleared the air of doubt and uncertainty and the industry can face the future with a clearer understanding of its position.

While examples of municipalities competing with private companies are not new, it has generally been accepted that electric utilities were largely free of the threat of competition from others in the distribution of energy within their territories. It was recognized that competing utilities within the same area not only created an unnecessary and wasteful duplication of investment but brought on other uneconomical practices. And so the public wisely has accepted the principle of regulated monopoly for utility services. While the economics of the situation have not been altered by the Supreme Court's ruling, the accepted principle of monopolistic operation of utility services has been severely shaken.

If one were to go back through the history of public utilities, including railroads and toll bridges and roads, it would be found that municipalities have for years and years been exercising this privilege of competition. In other words, the situation with the electric utilities has not essentially changed; it has become more definite and clearer.

Under such circumstances electric utilities without exclusive franchises, if they are to enjoy security from invasion of municipal competition, are faced with the necessity of building a customer good-will acceptance of the service that will be impregnable against political assault. Not only does this involve good service, low rates and a friendly attitude on the part of the consumer toward the utility, but also public understanding of the economic problems involved in municipal ownership even when the government is willing to advance a considerable portion of the cost of the project.

While there is a moral obligation on the part of government to refrain from destroying property and investment of citizens, this decision of the Supreme Court in the hands of an unfriendly Administration can be used to supersede the rights of states to regulate utilities within their jurisdiction. Is this what the public wants? Does the public want its state regulatory commission taking its orders from it or from Washington? Does the public want to pay bond charges on a municipal plant and lose taxes from the utility, without any positive assurance of better, if as good, service or of lower rates, just to get a gift from the government? Is the mess of pottage worth the selling of the birthright?

The legal courts have made it most evident that an appeal must be made to the court of last resort—the court of public opinion. What is necessary? Good service? Yes, the best. Low rates? The lowest possible to provide this service and a return that will attract investment. Public relations? The friendly feeling that comes from an honest desire willingly to do everything within reason for the customer. And, finally, public education? Education as to what the public stands to lose when municipal competition, through subsidies or otherwise, is used to usurp regulation.

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Why Half Elements?

IF ANY chemist started talking about half an element he would create quite a stir, because there can probably be no such thing. Meter engineers speak, however, of a $2\frac{1}{2}$-element meter and the coined phrase attains circulation. It has no due basis of validity, but what can we use in place of it?

Unfortunately there is no comparably short way of characterizing a four-wire meter which has two elements comprising two voltage electromagnets, two full current coils and a third split in halves which are wound with the other two. An element is a unit so named because the interaction of its components provides driving torque. It may be cumbersome to refer always to this meter as a two-element, three-current coil meter, but that is just what it is because no one by dissecting the meter could disclose the "half-element." The advent of the compacted polyphase meter spoils the chance to call it a superposed two-element meter.

Meanwhile committees are standardizing terminologies and drafting handbooks. Until something more acceptable is found they will have to weigh custom and habit against rigor of language before they drop this handy expression.

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The Question of Fairness

LAST WEEK Assistant Attorney-General Robert H. Jackson, who has been mentioned as the successor to the New Deal presidential mantle, and Wendell L. Willkie, president of Commonwealth & Southern Corporation, in a joint broadcast at "America's Town Meeting of the Air" presented their views on the subject "Co-operation Between Government and Business."

After the broadcast the speakers answered questions asked by people who attended the meeting. The answer by Mr. Jackson to one such question is most illuminating as it states so clearly a principle of the Administration that many have suspected, but had not before heard spoken in so many words by an important government official:

> A man to Mr. Jackson: Do you think the right way to get low electric rates is to subsidize municipal competition with 50 per cent grants and tremendous taxation?
>
> Mr. Jackson: I don't think the question of fairness enters into it. I don't know that it is necessarily fair for two policemen to arrest one crook. But the government of the United States, if it is going to carry out its power policy, has got to use competitive methods, because we have seen the methods of regulation break down.

In the heat of debate and questioning, when one does not have time to make a carefully prepared statement, the unvarnished hard facts are apt to leap out. And undoubtedly Mr. Jackson later would have liked to have been able to recall those words. But there they are—"I do not think the question of fairness enters into it."

How can the government expect to secure wholehearted co-operation from business unless the element of fairness does enter into it?

•

Wire for the Long Pull

RISING intensities in interior lighting and relatively stabilized efficiency in electric power and industrial heating applications challenge the engineer to plan for and design wiring installations on a more liberal scale than many consider standard today. Howard E. Murphy of the Stone & Webster organization has been voicing this thought lately in a number of informal talks before New England electrical groups. He predicts that the day is coming when 60 rather than 15-ft. candles will be considered on the office table and desk as a widespread measure of good modern practice, and that by the same token factory lighting will rise from the 10 or 20 to the 40 ft.-candle level for what might be called every-day acceptance.

Wiring installed today on the basis of present load demands is certain in many cases to be hopelessly out of date when the service needs of five years hence are faced. The upward trend in industrial plant loading in relation to employee numbers is highly significant, in the long view. Mr. Murphy instances a rise in a 500-employee plant from 2,000 kw. to 4,000 kw. in a comparatively few years. Pressure upon industry and business for economical operation increases steadily. Therefore the approach to future service requirements which simply cannot be denied in face of manufacturing progress and cost control needs must be down the wide avenue of co-operative planning in the electrical industry. The slow and circuitous route of pinchpenny design of wiring is too narrow an alley for satisfactory progress for either the electrical industry or its customers to select.

New Census Will Include Government Projects

MORE than usual interest attaches to the Census of the Electric Light and Power Industries for the year 1937, on which the Bureau of the Census is now engaged.

Heretofore the quinquennial census has covered the operations of privately owned and municipal systems only. This time the inquiry will cover, in addition to privately owned companies, all government-owned operations—municipal, federal, state, county power districts and mutual or co-operative systems rendering service from their own generating facilities or from purchased energy.

The published statistics will, therefore, present a comprehensive picture of the industry as it stands today, including the new agencies that have come into existence since 1932, the last census year.

Obviously the publication of results will be speeded up by prompt co-operation on the part of the utilities and by the complete filling in of the items requested in the questionnaire. The last census embraced 3,429 establishments. In this number were many hundreds of small ones. It is important that all those addressed, small as well as large, contribute their data with a minimum of delay.

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A Word of Thanks

FOR more than a third of a century ELECTRICAL WORLD has been presenting annually the statistics of the previous year's operations of the electrical industry. In this, our thirty-fourth annual statistical issue, we present original material compiled by our own staff as well as data from a number of other sources which we have reorganized to fit our particular form of presentation.

Wherever possible, we have made use of data compiled by national associations and other organizations of recognized statistical competency, gathering original data direct from the field only in such instances where comparable information was nowhere else available. These data have all been co-ordinated and then broken down in such a way as to present a clear picture of the state of the industry at the beginning of the year. At the same time an attempt has been made to interpret the significance of the figures as showing trends.

To the several hundred utilities, as well as to such sources as the Edison Electric Institute, the National Electrical Manufacturers Association, Standard Statistics, Federal Power Commission, Rural Electrification Administration, and individuals too numerous to mention, all of whom so generously furnished us with data that made this compilation possible, we wish to express our appreciation.

News OF THE WEEK

Jackson Says Fairness Not Factor in Government Utility Competition

Assistant Attorney-General tells Town Hall meeting present methods must be used to carry out power policy — Willkie scores slurs on business — Asks for co-operation and end to bitterness to aid recovery

During the long and bitter fight between the government and the electric companies since President Roosevelt inaugurated his federal power program, the utilities have sought unsuccessfully to get an insight into the government's philosophy of subsidized competition which leads to destruction of private investment.

Last week, answering questions from the audience following his address before "America's Town Meeting of the Air," Assistant Attorney-General Robert H. Jackson stated the government's position.

Fairness not a factor

In answer to the question: "Do you think the right way to get low electric rates is to subsidize municipal competition with 50 per cent grant and tremendous taxation?" Mr. Jackson said:

"I don't think the question of fairness enters into it. I don't know that it is necessarily fair for two policemen to arrest one crook. But the government of the United States, if it is going to carry out its power policy, has got to use competitive methods, because we have seen the methods of regulation break down."

Speaking to a capacity audience of 1,700 and millions of radio listeners over an NBC network with Mr. Jackson on "How Can Government and Business Work Together?" Wendell L. Willkie, president of Commonwealth & Southern, scored the slurs on business by government officials and called for a stop to the "catchwords which have been so glibly used and the nonsense about sixty ruling families."

Asks for co-operation

Discussing the position of "big" and "small" business as to how they operate and what they mean to the national economy, Mr. Willkie said that the recent decline has become so serious that "government officials who at first sought to minimize it are now seeking frantically to make big business responsible."

Asking for co-operation and a spirit to give renewed encouragement, Mr. Willkie said:

"Surely business and government should put an end to the bitterness of recent years and sit down in conference like reasonable men with mutual tolerance and respect. But the purpose of this conference must not only be to plan intelligently for the future, but to review those laws which have been passed—to see whether they cannot be so modified as to stimulate business activity, without removing any of the appropriate social controls. And above all, while these conferences are proceeding, the American people should be spared the confusion of hearing what one government official says in friendship today, denied by another in hostility tomorrow."

Mr. Willkie assailed the "bedtime story telling us that the men who hold office in Washington are, by their very positions, endowed with a special virtue, that they are men of far vision and exceptional capacity," while on the other hand "so-called big business men are pictured as the ruthless dictators of sprawling industrial empires with no real ability except the talent for collecting money for themselves."

Refuting the claims that the TVA has been responsible for lowering the cost of electricity, Mr. Willkie said that Commonwealth & Southern has five northern companies wholly remote from the TVA. The average rate of these and the six southern companies is lower than that of any utility group in America. "The average rate of the northern companies is slightly less than the southern units," he said in answer to a question from the audience.

Important to recovery

Speaking of the utility industry, Mr. Willkie declared that "with its enormous demand for additional construction and equipment, it is the most important of all industries to our economic recovery." He said that since the pre-war years the cost of living has gone up about 40 per cent, and the cost of electricity has gone down by almost exactly the same per cent. "On an average, the American pays 9 cents a day for electricity or less than the government tax on a package and a half of cigarettes," he said.

Mr. Jackson, in continuing his assault on monopoly and "big" business, said that the people expect business as a whole "to furnish steady jobs for all who want to work and to furnish goods to make up that standard of living which our people have come to regard as American."

Roosevelt Declares Local Utilities, Government Can Reach Agreement

Tells Jackson Day dinner gathering that understanding would enable companies to obtain needed capital for construction — Says owners of 4% of utilities securities control $13,000,000,000 industry

Speaking at the annual Jackson Day dinner in Washington last Saturday night, where 1,200 of the party faithful paid $100 a plate, President Roosevelt struck again at the public utilities and reiterated his intentions that the Administration will not let up in its drive against the holding companies.

Referring to what he termed "concentration of control over large areas of industry beyond the needs of operating efficiency," President Roosevelt said:

"As you know, I have been discussing the problem of the electric utilities with business men and lawyers and public officials during the past month or two.

"I am convinced that the great majority of local or regional operating utility companies can come to an understanding with the government and with the people of the territories which they serve. That would enable them to obtain, within their own localities or regions, all of the new capital necessary for the extension or improvement of their services.

"But most of these operating companies are owned by holding companies—pyramided holding companies—which are finance companies, not operating utility companies. Very few investors in the operating companies have lost money. But thousands of investors have lost money in buying holding company securities which had blue sky above them instead of tangible assets behind them.

"The evil of utility holding company control will not grow in the days to come because this government has now passed laws to prevent similar occurrences in the future. But we have not yet corrected the existing evils that flow from mistakes of the past. We cannot condone their continuance.

"It has been estimated that there are outstanding some $13,000,000,000 of electric utility securities and that the substantial control of this total is vested in the hands of the owners of less than $600,000,000 of the total. That means that the ownership of about 4 per cent of the securities control the other 96 per cent.

"Here is a ninety-six-inch dog being wagged by a four-inch tail."

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Survey Shows School Lighting Inadequate

Inadequate or improper lighting in classrooms was seen as retarding the mental progress of nearly three-fourths of the school children in New York City in a recent report by Dr. Isidore Harry Goldberger, assistant director of health education for the Board of Education, following a two-year survey of school lighting facilities.

Dr. Goldberger's report, based on tests in fifty-nine typical classrooms in four of the city's boroughs, showed that 74 per cent of the desks in rooms he studied received much less than the recommended standard of 15 foot-candles on dull or cloudy days when lights were not turned on. However, even with lights turned on, only 9 per cent more of the pupils' desks were adequately lighted on dull days.

The reports indicated that minor changes in present equipment would improve quantity and distribution and light as much as 50 per cent, although Dr. Goldberger was convinced that installation of indirect lighting facilities would be the best solution. His recommendations, which he said could be made without great cost, to remedy present conditions, included: burning of electric lights at all times on sides of rooms away from windows, substitution of 200-watt bulbs for the 150-watt ones now in use, raising of all light fixtures to height of eleven feet six inches and use of translucent window shades, flat white ceiling light walls and dull-surfaced desk tops. He also advocated use of photo-electric cells for turning on lights when illumination fell below the standard.

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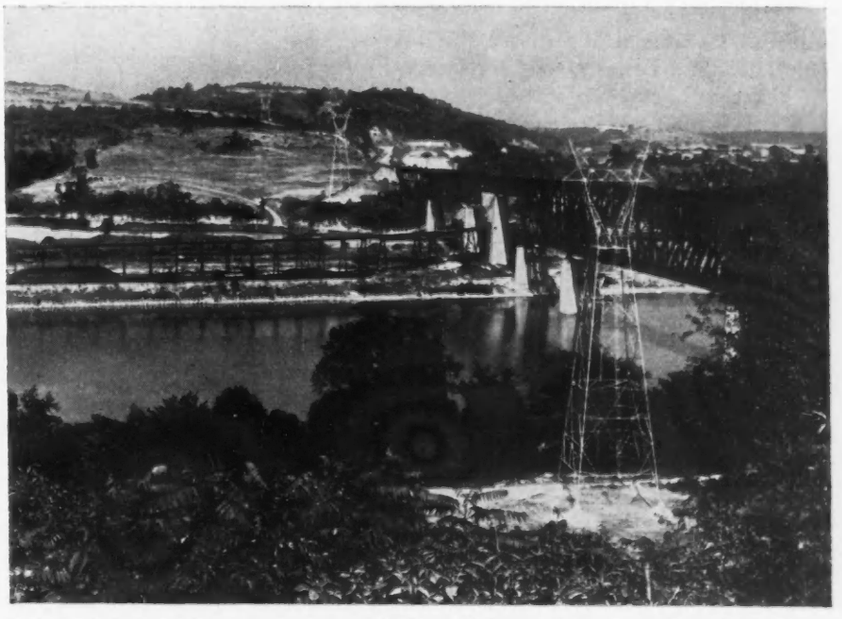
Fayetteville Files Suit

The City of Fayetteville, Tenn., has filed a brief in the State Supreme Court in its fight to uphold the constitutionality of a general law enabling municipalities to build power plants and distribution systems. The appeal seeks to invalidate a ruling by Chancellor T. B. Lytle of Columbia that the law is unconstitutional.



NEW TOWER LINE—Insuring a steady flow of dependable power, West Penn Power Company recently completed this Charleroi-Luxor 132-kv. tower line with 336,400-circ.mil ACSR conductor. River crossing structures are on the banks of the Monongahela River

Roosevelt Told How PWA Started Competitor With a "Good" Utility

West informs President that Nevada-California Electric supported New Deal utility act by registering with SEC and bought Boulder Dam power — Says PWA gave $2,760,000 allotment to duplicate lines

President Roosevelt this week continued his conferences with public utility leaders and was told how a "good" utility operating company which had cut rates and was giving efficient service was rewarded by having the PWA make gifts and loans to a competitor which had no funds.

It was the Imperial Irrigation District Co-operative which received $2,760,000, of which $1,242,000 was a gift from the PWA to compete with the Nevada-California Electric Corporation. A. B. West, president of the utility, told the President that his company had co-operated with the New Deal by registering with the SEC and complying with the utility act by merging operating subsidiaries to form one operating company, and had backed the public power development of Boulder Dam by purchasing its power.

Others at conference

President Roosevelt also met with Daniel C. Green of Central Service Corporation of Chicago and John Carpenter, president of Texas Power & Light Company. The discussions related to present developments on the All-American Canal in California and the Brazos and Lower Colorado Rivers in Texas.

Mr. West told Mr. Roosevelt that the PWA loan and grant were given so that the co-operative could parallel the lines of his company and duplicate its facilities. He told of how the 5 per cent bonds of his utility fell from $100 value at the time of the PWA allotment to $72 now.

California-Nevada Electric serves no large city, Mr. West told the President, but small separate towns and rural areas scattered over 50,000 square miles in eastern California and parts of Arizona and Nevada; that outlying areas are served with the same service as metropolitan areas; that his company had developed annual residential use to 1,266 kw.-hr., and that more than half of its residential customers have electric refrigerators and a quarter of them ranges.

In answer to the President's questions, Mr. West said that his company did not sell its facilities to the co-op because the co-op was "broke" except for the prospects of government money. The company could not even lease its facilities because of the same reason.

President Roosevelt said at his press conference that there would be more conferences with utility executives. He stated that the question of municipal competition was discussed, but added that the municipalities were the sole judge of what they wanted to do.

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Consolidated Plan Stirs Wide Interest

The new plan for the widespread promotion of the sale of electric appliances, in which Consolidated Edison Company of New York and its system companies and approved appliance dealers will co-operate, offers opportunity for the sale of $20,000,000 of such equipment, according to a statement made by E. F. Jeffe, vice-president. The new plan has produced more interest among other public utility companies than any other sales program of the past twenty years, Mr. Jeffe said. Inquiries concerning the plan have been received from virtually every utility system in this country and Canada, indicating that it may be widely followed.

For each kilowatt-hour of electric current consumed in a month a ½ cent merchandise credit is allowed by an approved appliance dealer on the purchase of an electric appliance at his store, this credit allowance not to exceed 25% of the purchase price.

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FPC Sets Power Hearings

Federal Power Commission has adopted orders for two hearings to be held in San Francisco, Calif., on February 14 and 16. The postponed hearing on the matter of the power capacity of project No. 708, license for which is held by Pacific Gas & Electric Company, and upon the annual charges due under said license and a recomputation of such annual charges will be resumed on February 14. Hearing on the application of Pacific Gas & Electric Company for a preliminary permit for project No. 1391, will be resumed on February 16.

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Supreme Court Kills Wisconsin Power Act

The Wisconsin Development Authority, conceived by Gov. Philip F. LaFollette and popularly termed "Wisconsin's little TVA," was killed by the State Supreme Court on January 11, when that body by unanimous decision declared that the 1937 Legislature illegally had given sovereign governmental power to the privately controlled corporation by delegating to it responsibilities which could be vested only in public officials.

The W.D.A. had the authority to own, purchase and operate publicly owned utility plants. Governor LaFollette had declared that its primary purpose was to aid municipalities in utility acquisition cases and to promote the federal rural electrification program. It was incorporated last spring as a private, non-stock, non-profit organization.

When Secretary of State Dammann blocked a $60,000 appropriation for one year's operation of the Authority, following protests by officials of the United Taxpayers' Co-operative Association, the Circuit Court was called on to decide the constitutionality of the act creating it. This court's decision that the act was constitutional was appealed to the State Supreme Court. Whether this body's ruling would, in turn, be appealed to the United States Supreme Court was not evident this week.

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Prolonged Treatment Urged for Electric Shock Patients

Prolonged artificial respiration treatment of persons suffering from electrical shock was recommended recently by medical authorities following studies carried out under auspices of the Harvard Medical School and the Boston City Hospital by Dr. Leo Alexander. No persons, the report said, should be pronounced dead, however seriously shocked, until

twelve hours of artificial respiration had been tried or until rigor mortis had set in.

Dr. Alexander quoted authorities to show that "in groups of workers who are well trained in the prone-pressure method of artificial respiration and who keep it up for sufficiently long periods, the recovery rate is high, 67 per cent." The importance of beginning artificial respiration as soon after the shock as possible was indicated by the fact that the recovery rate was 70 per cent when treatment was begun within three minutes after the shock, and 58 per cent after four minutes.

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Plans Made for Prague Fair

The upswing in the Czechoslovak foreign trade in 1937 has influenced very favorably the Prague Fair, the central market for the country's industry. Plans for the spring fair, to be held from March 11 to 20, are now well under way. There will be more than 3,000 exhibitors, new and important exhibitors having been acquired in all Czechoslovak export lines.

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Memphis Projects Approved

Plans and specifications for three projects of the Memphis, Tenn., municipal power system, costing $224,000, have been approved by Kenneth Markwell, chief PWA project engineer at Chattanooga.

Wide Search Into Affairs of TVA Sought in Congressional Inquiry

Representative May of Kentucky lists charges against Federal Power agency and asks light on breach between directors — Senator Norris moves that Federal Trade Commission investigate activities of utilities

A thorough search into the affairs of the Tennessee Valley Authority and the breach between Chairman Arthur E. Morgan and the two other directors, Harcourt A. Morgan and David E. Lilienthal, is expected as a result of the resolution recently introduced in the House by Representative May of Kentucky.

Mr. May stated that only through a Congressional investigation could all the facts be learned. He said that from "reputable sources" have come charges against TVA "persistently" over a period of years.

He listed the charges as follows:

1. Extravagance and careless wastefulness.
2. The practice of deceptive or untrue propaganda, both open and secret, in the press, the radio, in the schools and in the church.
3. Internal discord and selfish struggles and bickering for power within the organization, with a resultant breakdown of morale among the personnel.
4. Favoritism in settlement of claims for land purchases, together with an autocratic and merciless attitude toward politically unimportant home-owners dispossessed by reservoir floods.
5. Neglect of the affairs of national defense, one of the fundamental responsibilities of TVA, for its "incidental function" of power development and sale.
6. The offering of unfair inducements to industrial organizations to leave their established locations to settle in TVA territory.
7. Partiality to giant corporations over the small consumer in power contracts.

Norris proposes inquiry

Recently Senator George W. Norris, Independent, of Nebraska, proposed a thorough investigation by the Federal Trade Commission of the TVA. The Norris resolution would provide an inquiry broad enough to cover the dispute among TVA directors and the activities of power companies in relation to the project.

The condemnation proceedings, in which Senator Berry of Tennessee figured so prominently, over certain marble leases flooded by waters of TVA dams would also figure in the investigation.

Mr. May characterized the Norris resolution as a "further expedition into the affairs of private power companies and the courts, rather than an investigation of the TVA."

It was stated by Mr. May that his investigation would seek to determine why the TVA directorate had "misrepresented" plans for a proposed dam at Gilbertsville, Ky., when seeking funds for the $112,000,000 project and why the agency had "flaunted" the law with regard to reporting to Congress on the cost of TVA activities.

Mr. May proposed that the military affairs committee conduct the investigation into TVA affairs.

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Certificates for Lighting Installations in New York

To further modernization projects in its territory, the Electrical and Gas Association of New York will award certificates of merit for outstanding lighting installations in commercial, industrial, outdoor lighting and sport areas and public buildings.

Installations must be located within Greater New York City and must conform to four standards: Illuminating

Westinghouse

DIRECT LIGHTING—DIRECT BENEFITS—Forty-four of these new direct-lighting units, spaced 10 ft. apart on a 15-ft. ceiling, provide an average lighting intensity of 23 ft.-candles, using 200-watt lamps, in the Lafayette, Ind., store of the McClellan Stores Company. Plastic louvers with a cut-off for the direct rays remove the objectionable feature of glare from that type of illumination

Engineering Society table of foot-candle levels; brightness ratio and measures of the I.E.S.; wiring standards established by the Industry Committee on Interior Wiring Design and standards of the Electrical and Gas Association of New York. The Association will judge the installations on bases of effectiveness and efficiency of installations from the commercial, industrial, decorative or sales point of view, according to the installation.

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Columbia Gas Files with SEC Under Act

Columbia Gas & Electric Corporation became the fourth major utility holding company to register with the SEC under the Utility Act when it filed its registration statement last Thursday.

So far North American, American Water Works & Electric and American Light & Traction have filed with the SEC, following the decision of Judge Mack in holding the registration provisions of the act constitutional.

SEC Chairman Douglas, commenting on the action of Columbia, stated that the Commission welcomed the decision of the company to register and join in tackling some of the common problems faced both by the government and by the industry.

Edward Reynolds, Jr., president of Columbia, stated that the company has been considering registration for more than a year. In explaining the company's position he said:

> In anticipation of its future financial requirements the management of Columbia Gas & Electric Corporation, in consultation with members of the Securities and Exchange Commission and its staff, has been engaged for some months past in the formulation of a voluntary plan to enable the corporation to meet such requirements as they arise in conformity with the terms of the Public Utility Act of 1935. Throughout this effort the cooperation and helpful advice of the Commission and its staff have been of great assistance.
>
> The purpose of the plan, which is not conditioned on any public financing, is to make such corporate changes as will enable the Commission to find that the corporation and its subsidiaries constitute an integrated public utility holding company system and also comply with the other requirements of section 11 of the act.
>
> The directors of Columbia Gas & Electric Corporation have decided, as a result of these conferences, that the corporation should register under the Public Utility Act of 1935. They have today formally authorized the officers to do so.
>
> The corporation feels confident that the Securities and Exchange Commission will give its careful and prompt consideration to the plan as finally presented after working out the remaining details.

Power Commission Claims Utilities Originated Regional Power System

Defends 7-TVA plan proposed by President Roosevelt as extension of policy now being carried out at Boulder Dam and TVA — Urges prudent investment be used as basis of utility valuation and rate making

Regional development, control and operation of power facilities was not originated by the government, but by the holding companies whose empires cover whole sections and whose networks of power lines spread over many states, the Federal Power Commission states in its annual report.

The commission stated that "no more striking exemplification of their spread has been given than in the maps and reports of our National Power Survey, which showed that approximately three-fourths of the electric energy for public use was generated in only 223 plants, and nine-tenths of the electric business was transacted by only 107 systems, nine groups controlling practically one-half of the entire industry in the United States."

Supports 7-TVA plan

It was said that it was the "exposure of these conditions which augmented the demand for regulation of holding companies" and the passage of the utility act which would give the FPC authority over interstate electricity business and wholesale power rates.

The commission emphasized its support of the President's regional planning for the creation of seven TVAs. It was said that the regional planning proposal was an extension of the policy now being carried out in Boulder Dam and the TVA.

The commission defended the prudent investment principle in rate making and urged that the Supreme Court reverse the doctrine of Smyth vs. Ames, which set forth that, among other things, reproduction cost must be considered in determining fair present value of utility property. The commission had asked the court to take that stand in the Pacific Gas & Electric case, which has been sent back to the lower court to determine whether rates set by the California commission are confiscatory.

"If, in fixing interstate rates, reproduction cost must be considered," the report stated, "the commission's administrative task will be well-nigh impossible of performance. A sound basis upon which public utility properties should be valued for rate-making purposes is the prudent investment in such properties."

It was pointed out by the commission that of the 1,511 privately owned electric utilities in the country, 292 with claimed assets of $10,000,000,000 clearly fall within the scope of the Federal Power Act, and 261 others with claimed assets of $3,000,000,000 have been classed as "intermediate" in the absence of more exact information as to their interstate character.

"Since the commission is standing on the threshold of a new era of federal regulation involving an industry which for the first time has been subjected to the regulatory power of the Congress and is faced with the important function of rate-making," the report stated, "it is deeply concerned in the establishment of a legal principle which will be consistent with and not obstructive to a sound administration of the rate-making power."

Uniform accounts system

Reviewing its work, the commission stated that nation-wide uniformity in electric utility accounting has been notably advanced by the uniform system of accounts adopted by the commission and the National Association of Railroad and Utilities Commissioners. So far 21 commissions have adopted this general system.

The commission upheld its stand in opposing the Connecticut and Merrimack Valleys flood control compact between the New England States.

The report showed that 56 new applications for licenses or preliminary permits for power projects were received during the fiscal year, making a total of 1,442 received during the seventeen years of the commission. Seven new applications for prelimin-

ary permits covered proposed total installation of 496,000 hp.; the ten applications for license for major projects make a proposed total installation of 679,965 hp.

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State Court Denies Co-op. Road Rights

West Virginia Supreme Court has refused the petition of the Hardy County Power & Light Company for a writ allowing it to use road commission rights of way for power poles. The court did not hand down an opinion in the case, which involved indirectly whether a rural electrification co-operative is a public utility and subject to regulation of the Public Service Commission.

The Appellate Court will receive shortly the Public Service Commission's case as a result of the recent refusal of Judge Harlan Calhoun of Hardy County to grant an injunction against the co-operative.

Attorney-General Clarence Meadows had asked the injunction to halt any activities of the organization until it got a certificate of convenience. The co-operative, financed by the Rural Electrification Administration, claimed it is not a public utility because it serves only members.

Supreme Court Ends Buzzard Roost Fight

The U. S. Supreme Court has acted to permit Greenwood County, South Carolina, to begin work at once on its Buzzard Roost power plant. At the request of Solicitor-General Stanley Reed, Chief Justice Hughes ordered that the South Carolina Federal District Court be notified immediately of the recent Supreme Court decision that the Duke Power Company had no right to challenge Public Works Administration loans and grants for construction of the dam.

Ordinarily 25 days is allowed between the Supreme Court decision and issuance of its "mandate" to the lower court. This is to permit the losing litigant to ask for a rehearing if desired. Mr. Reed told the court that the Duke company had decided not to file a petition for a rehearing.

As a result of the Supreme Court ruling PWA has already asked that seventeen injunctions against PWA power projects be dissolved and will shortly ask that all other like injunctions be similarly dissolved.

In the following cases the government has served notice on the attorneys for the plaintiffs that it will ask for a dissolution of the temporary injunctions at the expiration of the time noted and has filed motions in the District Court of the District of Columbia to dissolve the injunctions:

Birmingham Electric Company, Tarrant City, Ala.; Arkansas Utilities Company, Paragould, Ark.; Iowa-Nebraska Light & Power Company, Sutherland, Columbus projects, Keystone Reservoir; Kansas Power Company, Hoisington, Kan.; Memphis Power & Light Company, Memphis, Tenn.; Iowa Southern Utilities Company, Lamoni, Iowa; Northern States Power Company, Janesville and Glenwood, Minn.; Illinois Power & Light Corporation, Jacksonville, Ill.; Missouri Power & Light Company, La Plata, Mo.; Minnesota Power & Light Company, Eveleth, Minn.; Tennessee Electric Power Company, Lewisburg and Lenoir City, Tenn.; Ky.-Tenn. Light & Power Company, Paris, Tenn.; Community Public Service Company-Lower Colorado River Authority, Tex.; Nev.-Calif. Elec. Company-Imperial Irrigation District, Calif.; Metropolitan Edison Company, Myerstown, Pa.; Ky.-Tenn. Light & Power Company, Newbern, Tenn.

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Government Charges Utility Assets Wasted

An investigation of alleged wasting of assets of the Eastern Utilities Investing Corporation, Associated Gas & Electric subsidiary, was asked last week of the United States District Court in Wilmington, Del., by the federal government, which told the court that the remaining assets of the company would not satisfy a $3,460,059 federal tax claim.

The petition said the government believed evidence would be produced which would result in "valid claims and causes of action, which, if successfully prosecuted, would result in the recovery of additional assets of substantial value for the debtor (Eastern Utilities)." The government also asked the court to subpoena several Associated Gas officials and investment bankers.

Asked to comment on the charge, officials of Eastern Utilities declared they were certain no "improprieties had occurred," "notwithstanding the fact that the federal government had made certain claims in its petition."

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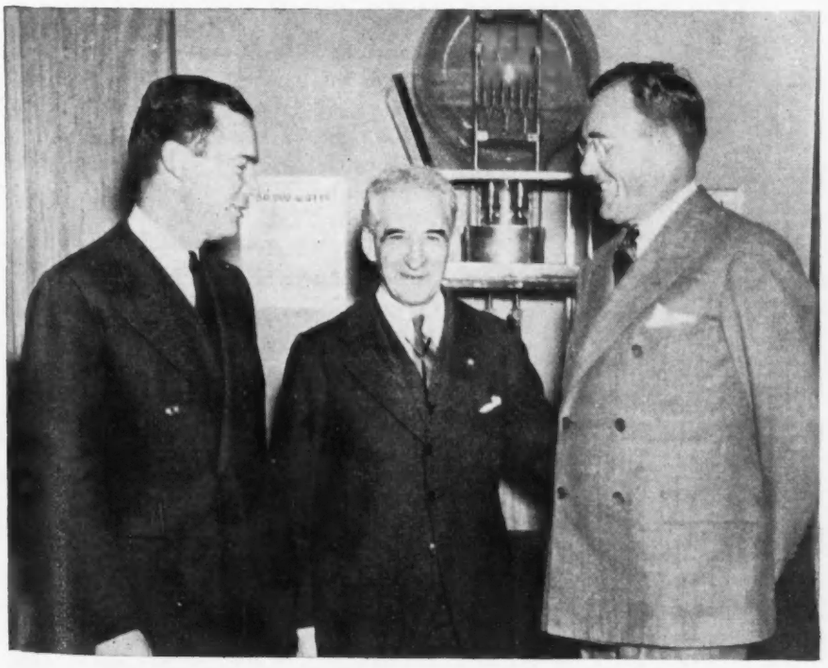
Tomahawk Hearing Delayed

Hearing scheduled for January 10 on the proposal of the Wisconsin Public Service Corporation to reconstruct the power plant and existing timber and rock-fill dam on the Wisconsin River at Tomahawk, Lincoln County, Wis., has been postponed until February 10, according to an announcement by the Federal Power Commission. The continuance was made at the request of the state.



TAKE OVER NEW DUTIES—Gerard Swope, president of General Electric Company, discusses new duties with Philip D. Reed (left), recently named assistant to the president, and Charles E. Wilson (right), new executive vice-president

A.I.E.E. Sets Program for Winter Convention

Two symposiums on electronics and one on modern electric vehicles, together with an address by Dr. H. G. Moulton, president the Brookings Institution, Washington, D. C., on "Technological Developments in Relation to Economics," at the general session on Wednesday, will be features of this year's winter convention of the American Institute of Electrical Engineers, to be held in New York City, January 24-28.

Included among the sixteen technical sessions scheduled for the convention will be those on television, cables and research, two sessions on communications, one on sound and vibration measurements, relays and factors, basic sciences and a conference on definitions. As before, electric welding, instruments and measurements, lightning and protection, power transmission and electrical machinery will be subjects for discussion.

Presentation of the Edison Medal will be made on Wednesday evening to Gano Dunn, "for distinguished contributions in extending the science and art of electrical engineering, in the administration of great engineering works and for inspiring leadership in the profession." A post-convention cruise to Bermuda is being offered again this year, in view of the success of last year's.

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Boulder Dam Return to Be Higher in Year

Although originally scheduled for completion in 1939, Boulder Dam on the Colorado River returned to the federal treasury, by the end of 1937, more than $2,000,000, according to a report by John C. Page, Commissioner of Reclamation.

Although the firm power rate did not go into effect until June 1, 1937, and only one-quarter of the generating machinery has been installed, the sale of power has already brought in more than $1,100,000. In addition, $906,000 has been paid by power purchasers as installments on the cost of generating equipment. At the present time the plant is turning out between 130,000,000 and 150,000,000 kw.-hr. per month.

During 1938 it is estimated that power revenues will reach $2,500,000 and machinery payments will aggregate $1,000,000. Two additional generators will go into service during the coming year and two more are already ordered—all of 82,500 kva. capacity.

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World Power Conference Plans for Vienna Meeting

Preparations are now under way for the World Power Conference, which will be held in Vienna from August 25 to September 2, 1938, according to a report to the Bureau of Foreign and Domestic Commerce from the American Commercial Attache, Vienna. Subjects to be discussed include electric power requirements for agriculture, trade, the household, public utilities and electric railways.

O. C. Merrill, first vice-president of the International Executive Council of the World Power Conference, with offices in Washington, D. C., is in charge of arrangements for United States' participation in this event.

Meetings

Missouri Valley Electric Association—Power sales conference, Muehlebach Hotel, Kansas City, Mo., January 20-21. Ford Bates, chairman, Nebraska Power Company, Omaha.

American Society of Heating & Ventilating Engineers—Annual meeting, Grand Central Palace, New York, N. Y., January 24-28. A. V. Hutchinson, secretary, 51 Madison Avenue, New York, N. Y.

American Institute of Electrical Engineers—Winter convention, New York, N. Y., January 24-28. H. H. Henline, national secretary, 33 West 39th Street, New York, N. Y.

Canadian Electric Association—Annual winter conference. Windsor Hotel, Montreal, Que., January 31–February 1.

National Electrical Manufacturers Association—Midwinter meeting, Waldorf-Astoria Hotel, New York, N. Y., February 7-12. W. J. Donald, managing director, 155 East 44th Street, New York.

Edison Electric Institute—Prime movers committee, Netherland Plaza Hotel, Cincinnati, Ohio, February 6-7; electrical equipment committee. Netherland-Plaza Hotel, Cincinnati, February 7-8; transmission and distribution committee, Brown Hotel, Louisville, Ky., February 9-10.

American Institute of Mining and Metallurgical Engineers—Annual meeting, February 14-17, New York, N. Y. A. H. Parsons, secretary, 29 West 39th St., New York.

Water Heater Group to Give Cash Prizes

Cash prizes totaling $3,000 are being offered in five contests planned by the National Electric Water Heater Council as part of the 1938 activities. In announcing the contests, C. G. Hillier, chairman of the National Electrical Manufacturers' Association water heater sales committee, placed 1937 sales at 50 per cent over 1936.

One contest, open to all electrical utilities, offers a national prize of $1,000 and a silver cup to the utility doing the "best all-around water heating job in 1938." Major points to be considered are increase in volume over previous year, saturation increase, unit volume and general excellence, rather than size or cost, of the plan. In a second contest, $400 in cash prizes will be given for the best newspaper advertising campaigns of utilities and dealers on electric water heaters, copy to have appeared in 1938 and before July 31.

An electric water heater window display contest, open to utilities and dealers, offers $250 in prizes for the displays, appearing before July 1, having greatest sales appeal and educational value. Thirty-six prizes of $10 each, three awarded monthly, plus a grand prize of $100, will go to salesmen writing the best letters on "How I Sell Electric Water Heaters." Finally, a contest for utility executives and engineers offers two prizes of $500 each for the best papers on "Advisability of Competitive Water Heating Rate and Advantages of the Water Heating Load." This contest will be open until May 1, 1938.

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Schedules Electrical Exhibit

The St. Louis (Mo.) Electrical Board of Trade has scheduled its Exhibit of Progress in Electrical Equipment for April 4 to 6 inclusive. Exhibition is aimed especially at those responsible for the purchase, installation or maintenance of electrical equipment used in industrial plants, commercial buildings and institutions.

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Reports Merchandise Sales

Merchandise sales of the Georgia Power Company in November were $240,502, totaling $3,114,790 for the eleven months' period.

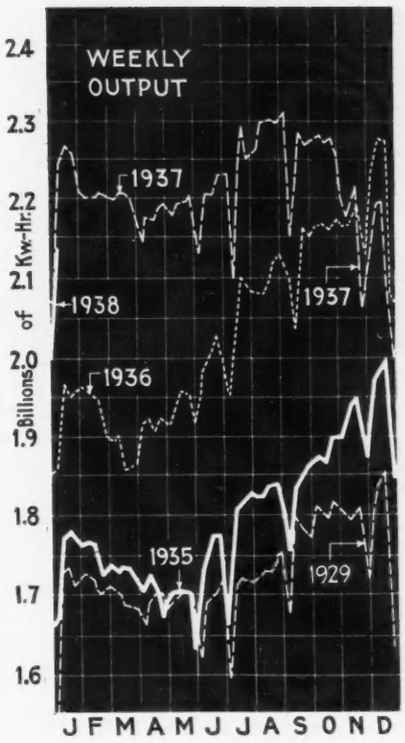
Energy Output Rises

First full week is 7% above the holiday low — Operations continue under a year ago

Recovering from the sag characteristic of the holiday period and rising 141,000,000 kw.-hr. over the figure for the week that included New Year's day, the output of energy by the electric light and power industry during the week ended January 8 amounted to 2,139,582,000 kw.-hr., according to the Edison Electric Institute.

This was 4.7 per cent less than in the week of January 9, 1937. The production curve therefore continues below that drawn a year ago, as has been the case since the latter part of November. Compared with the first full week in January two years ago operations show a gain of 169,000,000 kw.-hr., or 8.6 per cent.

For the week of January 1 the final report of 1,998,135,000 kw.-hr. supersedes the tentative figure previously given. Regional comparisons were not announced.



Weekly Output, Millions of Kw.-Hr.

1938		1937		1936	
Jan. 8	2,140	Jan. 9	2,244	Jan. 4	1,855
Jan. 1	1,998	Jan. 2	2,069		
1937		**1936**		**1935**	
		Dec. 26	2,081	Dec. 28	1,847
Dec. 25	2,085	Dec. 19	2,275	Dec. 21	2,002
Dec. 18	2,202	Dec. 12	2,278	Dec. 14	1,983
Dec. 11	2,196	Dec. 5	2,244	Dec. 7	1,970
Dec. 4	2,153	Nov. 28	2,134	Nov. 30	1,877

Per Cent Change from Previous Year

Region	Week Ending Jan. 8	Jan. 1	Dec. 25
New England	....	....	— 4.1*
Middle Atlantic	....	....	+ 2.1*
Central Industrial	....	....	— 5.0*
West Central	....	....	+ 2.1*
Southern States	....	....	— 2.8*
Rocky Mountain	....	....	— 0.5*
Pacific	....	....	+ 1.4*
United States	— 4.7	— 3.4*	+ 0.2*

*Adjusted for holiday conditions.

Power Output Shows Decline in November

Production of electricity for public use in the United States totaled 118,553,000,000 kilowatt-hours in the twelve months ended November 30, according to the Federal Power Commission.

Total production in November was 9,563,000,000 kw.-hr., compared with 10,148,000,000 kw.-hr. in October. This is a decrease of 5.8 per cent from the previous month and, on a comparable basis, an increase of 2.5 per cent over November, 1936. Average daily production in November was 318,753,000 kw.-hr., 2.6 per cent less than that in October. Production by water power in November was 38 per cent of the total.

Total stock of coal on hand at electric utility power plants on December 1 was 10,338,582 tons, of which 8,956,341 tons were bituminous coal. This was a decrease of 2.7 per cent when compared with November 1 and an increase of 30.1 per cent over December 1, 1936. Electric utility power plants consumed approximately 3,585,798 net tons of coal in November.

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Power Output in Texas Up

Electric power consumption in Texas during November maintained a wide gain over the corresponding month last year and the decline from October was no greater than the average seasonal decline between these two months, according to the University of Texas Bureau of Business Research. Reports from sixteen major electric power companies with total production during November of 200,806,000 kw.-hr. show an increase of 14.9 per cent over November last year and a decline from October of 7.6 per cent, the bureau's report said.

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House Passes Appropriations But Limits TVA Dam Requests

The House late last Tuesday passed the Independent Offices Appropriation bill carrying $1,500,000 for the Federal Power Commission; $9,907,000 for SEC; $31,652,000 for REA; $37,237,000 for TVA. Budget recommendations were followed except for a reduction in the TVA appropriation which defers the start of construction on the Gilbertsville Dam.

Debate indicated that this dam will not be authorized until the present dissension among the TVA directors is cleared up. However, an item of $285,000 is contained in the bill as passed for further study of the Gilbertsville site.

•

Grand River Hearing Set

Announcement has been made by the FPC that a hearing will be held on January 27 on the proposal of the Grand River Dam Authority, Vinita, Okla., to construct a dam and hydroelectric plant on the Grand River in Mayes, Delaware and Ottawa Counties, Oklahoma, for the purpose of flood control and power development. Included in the proposed development is a generating plant with installed capacity of approximately 80,000 hp.

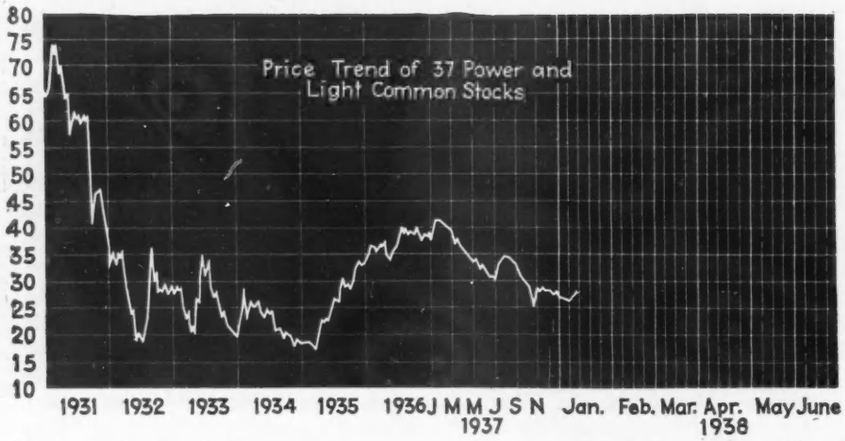
•

Electric Sales in Illinois

Sales of energy to ultimate consumers in the state of Illinois in November, 1937, increased 5.6 per cent in revenue, 2.6 per cent in kilowatt-hours and 2.5 per cent in the number of consumers when compared to November, 1936, according to an announcement by the Illinois Commerce Commission. With the exception of the number of consumers, these rates of change over the corresponding month of the previous year are the smallest gains recorded in several months.

For the past several months rural sales have increased at practically a constant rate of change when compared to the same month of the previous year. November increases of 41.1 per cent in revenue and 46.9 per cent and 36.5 per cent in kilowatt-hours and consumers, respectively, have proved no exception to the rule.

Utility Stocks Continue Gains



Utility stocks shared the current upswing of the general market as they continued their advance this week, showing encouraging gains for second consecutive week. "Electrical World" index, 27.9; previous week, 26.8; year ago, 41.5, 1937's high

Refinancing Plans Approved by SEC

SEC has approved the reorganization plan of Keokuk Electric, Fort Madison Electric and Dallas City Light companies under which a further simplification of the North American Company system will be attained. The three companies are subsidiaries of Central Mississippi Valley Electric Properties, a subsidiary of Union Electric Company of Missouri, which in turn is controlled by North American.

The plan provides for the transfer of all the properties and assets of Fort Madison Electric and of Dallas City Light to Keokuk Electric in exchange for no-par common to be issued by the latter at $45 a share, equal to the net book value, less liabilities to be assumed. Also, after adjustments to eliminate certain intangibles of the properties to be acquired.

Upon completion of the exchange Fort Madison and Dallas City Light are to distribute the Keokuk stock they receive to Central Mississippi as a liquidating dividend. That company, thereupon, in liquidation, is to distribute its assets, which will then consist of all the outstanding common of Keokuk, to Union Electric.

Application by the Cumberland County Power & Light Corporation, a subsidiary of the New England Public Service Company, for acquisition from the Twin State Gas & Electric Company of 9,770 shares of $25 par value common stock and $224,000 of first and refunding mortgage 5 per cent gold bonds due in 1953 of the Berwick and Salmon Falls Company has been approved by SEC.

•

United Corporation Talks Registration

Efforts to clear up many of the controversies arising over the registration provisions of the Utility Holding Company Act as they apply to United Corporation are being made by company officials and the SEC. With the possibility that the Supreme Court will hand down a decision in the Electric Bond & Share case within the next two months, United Corporation is seeking to learn its status and what course it may have to follow.

Discussions with the SEC have been going on for some time, but nothing tangible have come of them so far. However, understandings on some problems have been reached and plans have been discussed as to what procedure the company should follow should the government be upheld in its "hand-picked" case.

United Corporation has always considered itself an investment company, as it has never owned directly or indirectly a majority of the voting stock of a utility.

A special meeting of stockholders will be held February 1 to vote upon a proposed reduction of capital from $197,109,220 to $138,965,099, through reduction of the stated value of the common stock from $5 to $1 a share. The meeting will be held in Wilmington, Del., following the annual meeting of stockholders.

The action will be taken in keeping with Delaware laws which prohibit dividend payments where the market value of a company's portfolio falls below the stated value of its capital.

•

N. Y. Steam Offer Extended

New York Public Service Commission has extended to February 15 the period within which the Consolidated Edison Company of New York may issue 92,134 shares of its $5 cumulative preferred stock in certificates of whole shares and in scrip certificates for fractional shares, in exchange for the preferred stock of the New York Steam Corporation. The company petitioned for an order extending the period until March 1, 1938.

The original order, made last July, provided that the period was limited to not later than September 1, 1937. The latest petition of the company for an extension showed that 93 per cent of the outstanding preferred stock of the Steam Corporation had been presented for exchange.

•

Says Balance Sheet Doctored

The balance sheet of Staten Island Edison Company for 1936 was not a transcript of the general ledger "in its entirety," William A. Kienzle, controller, treasurer and director of the utility, admitted last week to the New York Public Service Commission. The commission is investigating the utility's accounting methods, following Mayor La Guardia's statement that he believed the company could reduce its electric rates by $450,000 a year.

Earnings Reports (Utilities)

	Net Income 1937	1936
†Elec. Pwr. & Lt. and subs.	$9,497,778	$7,544,629
†United Gas Corp. and subs.	11,185,379	11,094,855
*Cons. G. E. L. & P. Balti. and subs.	6,582,998	6,411,067
*Pennsylvania Pwr. & Lt.	8,047,014	8,131,240
*Virginia Elec. & Pwr.	2,231,470	1,959,631
*The Wash. Water Pwr. and subs.	2,738,374	2,669,239
*Wisconsin Pub. Serv. and sub.	1,436,931	1,135,546
*San Diego Cons. Gas & Elec.	1,337,532	1,361,845
*Oklahoma Gas & Elec.	2,797,601	2,248,986
*Arkansas Pwr. & Lt.	1,499,294	1,085,666
*Memphis Pwr. & Lt.	1,666,685	1,343,931
*Idaho Power	1,427,121	1,137,937

* Twelve months ended November 30.
† Twelve months ended October 31.

Type I-30 Watthour Meter Suitable for LARGE and SMALL Single-phase Loads

AN entirely new driving element, with a compensating shunt for high and low current values — and a new light-load and lag adjustment, which is compensated for the effect of temperature variations when loads of less than unity power-factor are being recorded. These are but two of the features that contribute to the wide-limit accuracy of the I-30 meter.

Even when uncompensated, the I-30 meter is remarkably accurate.

New Driving Element

The driving element contributes most to this inherent accuracy. As a result of its fundamentally correct design, the errors caused by variations in load, voltage, temperature, power-factor, and frequency are negligible, and only slight compensations are needed.

The load shunt not only compensates for heavy-load droop, but also improves performance at light loads, so that the resulting load curve is accurate to lower values of current.

Low Speed, High Torque

The damping torque that results from the current-coil flux is the chief cause of errors in registration on heavy loads. Since this error is directly proportional to the rotor speed, it follows that both the current flux and the disk speed should be low. The I-30 meter, therefore, in line with its immediate predecessors, uses low nominal speed combined with low useful current flux.

But—of equal importance is high torque, which enables a meter to maintain its accuracy, especially at light loads, for a long period of time and without attention. The I-30 meter possesses the high torque that characterizes all General Electric meters.

Makes Possible New Benefits

Wide-limit accuracy makes the I-30 meter suitable for large and small single-phase loads—and thus simplifies your whole metering program. In other ways, also, you profit—by reducing inventory investment and by cutting down on maintenance expense. Then, too, by assuring accurate performance, regardless of variations in load, the I-30 meter protects revenue.

You can get complete information from Bulletin GEA-2721A, a copy of which we shall be glad to send, or by calling a G-E meter specialist. Address nearest G-E sales office, or General Electric, Dept. 6-201, Schenectady, N. Y.

GENERAL ELECTRIC

400-28

Field OPERATING PRACTICES

New ideas and practices in the operation of well-designed, constructed and maintained plants and systems

Shunt Capacitors Improve Voltage

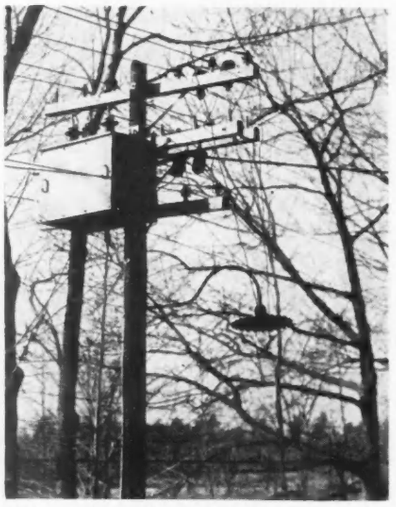
By W. H. ALLEN
Resident Engineer
New Hampshire Gas & Electric Company,
Portsmouth

The advent of thousands of appliances upon rural and suburban circuits changes materially the characteristics of feeders, often resulting in poor voltage regulation due to increased wattless current. The problem arises how conditions can best be improved. Shall we substitute larger wire and reduce a portion of the voltage drop, only to find our substation transformer banks and generators burdened with the same amount of wattless and sub-rated output? Shall we hastily install rotating corrective apparatus or shunt capacitors directly on the substation bus, where the voltage is kept high, correcting power-factor alone and still permitting long feeders to continue with a sizable proportion of its voltage drop?

Both of these problems can be solved simultaneously with a little study and a minimum of expense by the proper application of shunt capacitors on the feeder itself. Careful consideration must be given to the total capacitance required, the proper division into individual small units and the location yielding the maximum economic benefit. Recording kw. and kva. meters are valuable in this connection.

On our system the demand for service in rather isolated sections has resulted in many long single-phase laterals radiating from the mains, and too little thought has been given in the past to keeping these circuits balanced. This worth-while study usually discloses surprising conditions, which can be remedied in many cases by reconnecting the laterals or a few transformers on the mains. Economic benefits are gained ahead of the installation of capacitors. It is vitally important to know the connected kva. per phase of each circuit, as the capacitance correction required is in direct proportion to the phase load, the location of individual units being dependent on various load densities throughout the circuit length.

Capacitor unit (10 kva.) used on single-phase laterals



60-kva. three-phase capacitor on mains having concentrated loads

Our experience in applying small capacitor units carefully distributed has not only been translated into improved power factor, but voltage regulation and voltage gradient have been bettered unbelievably. Best of all, regulation remains constant at both full and light load periods. Units of 10 and 15 kva. rating have been specially economical, since these can be installed on any transformer pole having lightning protection and connected between the cutout and the transformer bushings. The transformer fuse size should be increased slightly, however. Larger three-phase capacitors of 30, 60 or higher kva. must be protected with arresters and cutouts unless it is feasible to locate these in some industrial substation where protection already exists. Small units mean less cost for relocation, especially on systems having seasonal loads.

This problem of wattless currents can no longer be restricted to industrial loads, for the magnetizing current required by our ever-increasing residential load, with its countless use of small motors, is fast becoming a problem.

A representative installation cares for a load of about 750 kw. This load is about equally divided on one power and two rural circuits operated at 2,300 volts. The former power factor was about 60 per cent. The careful application of 225 kva. in distributed capacitor units ranging in size from 10 to 60 kva. at a cost of $2,000 has

NONINFLAMMABLE, NONEXPLOSIVE

Pyranol Transformers

Show Savings at North Star Mine

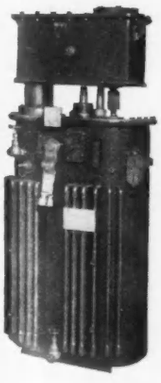
AT THE North Star Mine of the Empire Star Mines, Grass Valley, California, three 150-kva G-E Pyranol transformers were selected for the underground mine distribution system. They were installed at the 4000-ft level to supply the proper voltage for a new 500-hp G-E motor operating a pumping unit. The noninflammable, nonexplosive characteristics of the liquid dielectric Pyranol made possible the installation of the transformers underground at the minimum total installed cost commensurate with the highest degree of safety.

A gas absorber can be installed on the transformer or wall to prevent any gas generated from Pyranol from entering the mine, should a fault occur in the transformer.

Pyranol is non-sludging — therefore maintenance is minimized.

In mine installations it is often possible to realize substantial savings in total installed cost by specifying noninflammable and nonexplosive Pyranol transformers.

Three G-E 150-kva 4000-1100-volt Pyranol transformers installed at the North Star Mine



Pyranol transformer provided with gas absorber

For complete information send for a copy of Bulletin GEA-2048. General Electric Co., Schenectady, N. Y.

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PYRANOL CAN BE USED ONLY IN EQUIPMENT SPECIALLY DESIGNED FOR ITS USE

300-60

GENERAL ELECTRIC

raised the system power factor to 85 per cent, resulting in much improved feeder regulation even on circuits radiating 13 miles from the regulated substation bus. Eight distribution transformers aggregating 51 kva. which had formerly been used as feeder boosters (5 or 10 per cent fixed boost) were removed from circuits, which made some $700 worth of transformers available for revenue service, besides eliminating about $40 in annual core losses from the system.

Energy was purchased subject to penalties below 80 per cent power factor, these formerly approaching $250 a month. The application of capacitors during the summer months in advance of an all-time local system peak load saved more than $400 in August alone. Voltage complaints, annoying previously, were entirely eliminated. We do not know, of course, to what extent the improved regulation has increased revenue, but watt-hour meters have a habit of materially slowing down on potentials of 100 volts or less.

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Connector Press for Compression Joints

By E. WILLIAMS . . . C. N. METCALF
Consolidated Edison Company
of New York, Inc.

Compression type cable joints have been used on overhead transmission conductors for some time, but had not been found practical for underground work due, first, to the bulk of the pressing equipment required and, secondly, to the fact that solder connections are more economical as long as a solder pot and furnace are required for the wiping of a lead sleeve over a joint on lead-covered cables. With the extended use of non-leaded cables, it is now practical to use compression joints and thus completely eliminate the solder pot and furnace from the splicing operations. The use of fusible connections ("limiters") for selective protection of distribution cables is fundamentally dependent upon a compression type connection due to the necessity of avoiding a soldered connection which may become defective when subjected to high temperatures under fault conditions.

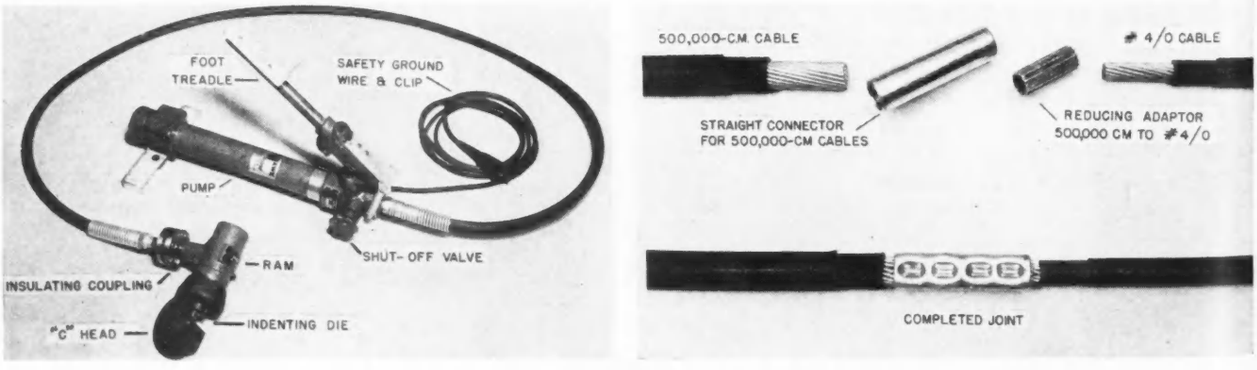
Several different types of explosive, mechanical and hydraulic connector presses have been developed which now provide a satisfactory means of making compression joints on underground cables within the space limitations experienced in the field. One of the most recent and promising of these is a novel design of hydraulic connector press, shown in the accompanying illustrations, which has been developed by the electrical engineering and distribution construction departments of the Consolidated Edison Company.

Operation of press in making live 500,000-circ.mil joint

This hydraulic connector press consists of a small hydraulic ram, flexible hose and separate pump arrangement available on the market for automotive body and frame repair work. To this is added a "C" hook type of head which screws directly on the ram and an indenting die which fits in the piston of the ram. Operation of the press can be visualized from the picture which shows the press assembly. The indenting die is actuated by the hydraulic ram, which is capable of exerting an indenting pressure as high as 16,000 lb. against the joint held in the "C" hook. The "C" hook is designed to hold a 500,000-circ. mil connector, and by inserting various adaptors in the hook it is possible to accommodate a range of smaller cable sizes.

The connectors used for this type of compression joint consists of seamless copper tubing, drawn to specific sizes, cut to proper lengths (3½ in. for No. 4/0 and 4 in. for 500,000-circ.mil cables) and then tinned. The connector is indented into the cable ends, as shown, resulting in a cable connection of satisfactory conductivity and ample pull-out strength. For connection on No. 4/0 or smaller cables only one indentation is made on each side of the connector or "limiter," while for larger sizes, such as 500,000-circ.mil cable, two indentations are made on each cable end. To make reducing connections from either 500,000-circ.mil or No. 4/0 connectors to smaller size cables special corrugated reducing adapters are inserted in the end which is to receive the smaller size of cable as shown. These have also been found to be entirely satisfactory.

In order to permit the use of the press on "live" conductors a high-pressure insulating coupling is installed between the ram and the hose. This is necessary because the rubber hose is reinforced internally with a steel wire mesh. The head, ram and insulating coupling are completely covered with insulation when the press is used on "live" work, and as an added precaution the pump is also grounded with a separate ground wire and spring clip.



Connector press for compression type cable joints

Operation of the press in making a joint is simple and fast. With the indenting die in the retracted position the head is hooked over the connector into which the conductors have been inserted to the proper length. The foot-treadle is then operated by the splicer or his helper until the correct depth of indentation has been made, as indicated by markings provided on the "C" hook. After the proper indentation has been made the indenting die is pushed back into the retracted position with a fiber rod or insulated screwdriver and is ready for the next indentation. About one minute is required to make the two indentations on a No. 4/0 connector and three minutes is sufficient to make the four indentations on a 500,000-circ.mil joint. Satisfactory compression joints are also made on 750,000- and 1,000,000-circ.mil cables, using a larger size of head and indenting die for the press assembly.

NOW 3 TYPES OF CLOTH-INSULATED CABLE

. . . . afford a choice from which to select the type best fitted for each job

YOU are no longer limited to the standard varnish-cambric for all jobs that call for a cloth-insulated cable. Of course, you can still get that old reliable—better now than it ever was—and, in addition, two other types: high-temperature and Glyptal. Here are facts that will help you to decide which type is best adapted for a particular job.

If you are at all in doubt as to which type is the best, a G-E cable specialist will be glad to help. The samples offered below will give you a still better idea of these types as well as of the quality of the cloth. Send the coupon to the nearest G-E sales office, or General Electric, Dept. 6B-201, Schenectady, N. Y.

No. 995 Cloth (Center)

This is the standard varnished-cambric. Cable insulated with it is adapted for general all-round work—up to 10,000 volts for three-conductor belted, lead-covered cable; up to 26,000 volts for single-conductor or multiconductor shielded . . . . with a conductor temperature not exceeding 75C-E*.

No. 1797 Cloth (Left)

This is the high-temperature cloth. Cable insulated with it is for the same service as black varnished-cambric, but is capable of being operated at the higher conductor temperature of 90C-E* (with a maximum of 85C) at voltages up to 7500. For voltages above 7500 and up to 15,000 the maximum allowable conductor temperature is 75C. Where heating is the limiting feature, this cable will show savings in copper and in duct space.

No. 1780 Cloth (Right)

This is the Glyptal cloth. Cable insulated with it is oil-resisting, tough, and long-lived. It can be operated at a conductor temperature of 85C at no more than 600 volts. It is recommended for low-voltage power circuits, for rewiring industrial and mining locomotives, and for general-purpose motor wiring.

**Where E = voltage in kv. Thus, the maximum conductor temperature in degrees centigrade (C) is obtained by subtracting the voltage rating in kilovolts from 75 or 90.*

FREE SAMPLES

General Electric,
Dept. 6-201,
Schenectady, N. Y.

Please send me a set of samples (GES-1657) of varnished cloth used for insulating G-E cable.

Name .....

Address .....

.....

520-117

GENERAL ELECTRIC

New ENGINEERING IDEAS

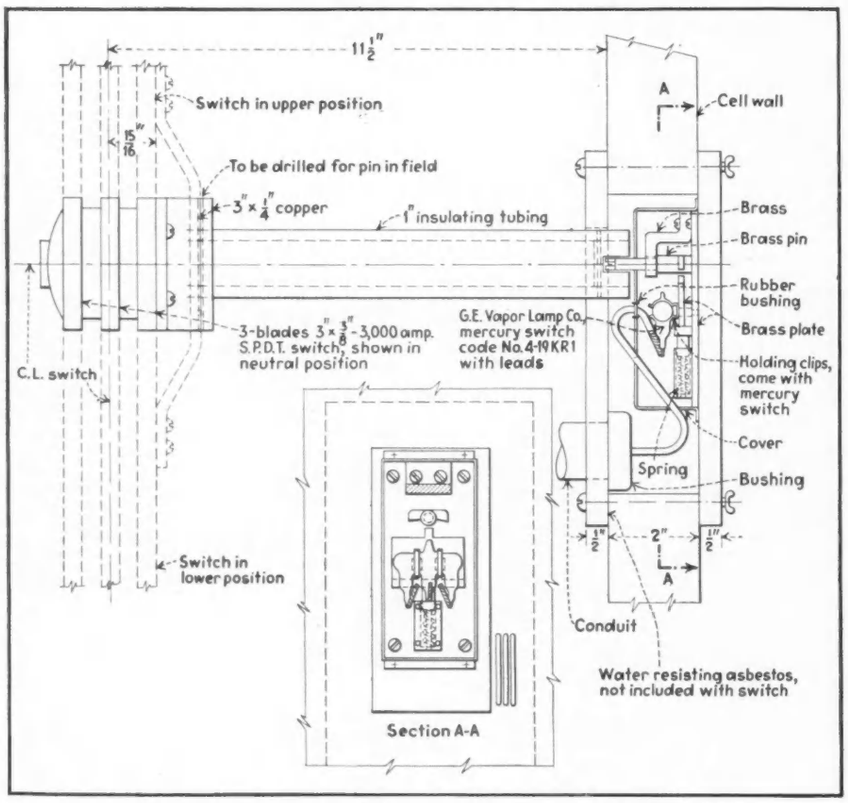
Discoveries, proposals and developments by electrical engineers and scientists in the field, the factory and the laboratory

Switch Position Given by Remote Indication

In a Southern industrial plant it became necessary to provide remote indication of the position of a 15-kv., 3,000-amp., single-pole, double-throw selector to show whether it was open, closed at top or closed at bottom position.

The problem was solved by making up a combination of the high-voltage switch with a mercury switch energizing the indicator circuit at 115 volts. The two switches were mechanically connected by an insulating tube 1 in. thick and about $9\frac{3}{4}$ in. long, attached at one end to the high-voltage switch by a copper clamping piece screwed to the switch blade and at the other to a rotating lug which engages with the mercury switch and turns it to close the indicating contact as the high-voltage switch closes in either position. A spring is provided to bring back the mercury switch to neutral position when the insulating shaft turns back to neutral after being opened from either upper or lower position, thus holding the mercury switch in readiness for the next operation.

The assembly was made by Thoner & Martens, Boston, Mass., to meet the special problem here involved.



Mercury control switch provides remote indication

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Dutch Concern Tests 150-Kv. Power Cable

A length of gas-cushion cable, to run at 150,000 volts, has since last February been on a continuous load and overvoltage test equivalent to 260 kv., three phase, at the field laboratory of the Dutch testing organization K.E.M.A. The run amounts to a total of over 7,000 hours and 300 heat cycles.

Construction of the gas-cushion cable is similar to that of the normal mass-impregnated type except that provision is made for the supply of gas at points along the length at a pressure of several atmospheres, to withstand which the lead sheath is reinforced externally. The effect of the pressure is to raise the dielectric strength of the cable very considerably, so that it can operate for indefinite periods at voltages which would cause rapid deterioration at atmospheric pressure. An extremely uniform power-factor voltage curve, indicating an absence of ionization, is, it is stated, being consistently maintained even at the highest voltages.

Also co-operating in these tests is the British concern W. T. Henley's Telegraph Works Company, Ltd., which has been in close touch with the Dutch body for past three years.

CHOOSE ANY TYPE TRUCK

But Be Sure To

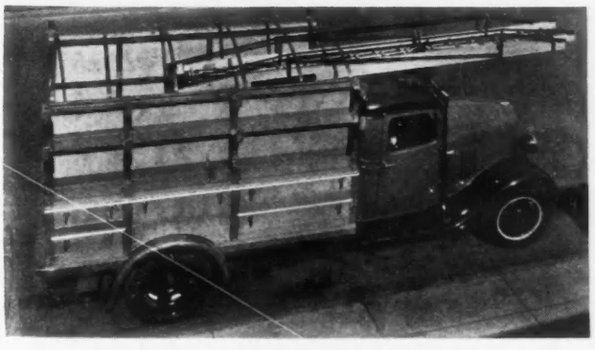
PUT A

MURRAY CROWSNEST

ON IT

In Kansas City, Mo.

In Jacksonville, Fla.



In Brooklyn, N. Y.

FOR the utmost in flexibility, adaptability, quick operation, durability and safety, put a CROWSNEST to work for you.

A CROWSNEST is adaptable for servicing street lights—trimming trees—for line and inspection work—connecting services and emergency work —for servicing fire alarm systems.

Its flexibility, because of 360° rotation and 10 angles of inclination, makes "spotting" rapid. A collapsible, level adjustable platform, supplies a stable footing for operator.

Materials conforming to most exacting standards assure durability and the sturdiness that means safety to life and limb. Tests disclose a generous safety factor is provided.

There are hundreds of CROWNESTS in use, keeping maintenance expense to a minimum.

A 20 page illustrated bulletin will be gladly sent on request.

METROPOLITAN DEVICE CORP.
BROOKLYN, N. Y.

MURRAY CROWSNEST

Industrial ELECTRIFICATION

New ideas and practices in industrial electrification as presented by industrial, consulting and power sales engineers

"Back-Up" Service Saves Investment

By D. W. LOUCKS
Duquesne Light Company, Pittsburgh, Pa.

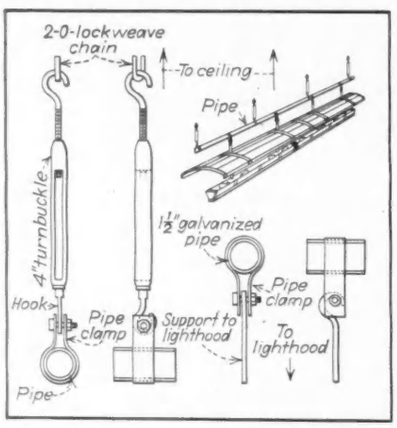
Light, heat and power for the Carnegie Institute of Technology is supplied from a 1,125-kw. steam-electric plant located at one end of the 54-acre campus approximately 3,000 ft. from the farthest building served. All service is direct current, three wire, 125/250 volts. The average peak load during the school term ranges from 550 kw. to 650 kw., more than 30 per cent of which is used at the opposite end of the campus from the plant.

As the school grew, the need for not only additional generating capacity but also additional distribution facilities became evident. Existing distribution lines were becoming overloaded and voltage drop at distant points on the campus was increasing.

It was discovered that if the plant could be relieved of about 125 kw. it could be depended upon to carry the remainder of the load with the largest (500-kw.) unit down for repair. Several small connections with the utility company had been made for night lighting. The use of these services grew to amount to approximately 30,000 kw.-hr. annually and the cost per kilowatt-hour averaged about 4.5 cents. Examination of load curves showed that part of the day load could be combined with service from the utility, without pyramiding the demands, and that the cost of the energy that could be purchased on a single contract by combining a day load not to exceed 150 kw. with the service already purchased at night would, in all probability, be slightly over 1 cent per kilowatt-hour. Such a block of load could be obtained by taking over the lighting in several of the buildings and was the solution to the problem of plant capacity, but not to the problem of distribution capacity, which was still an obstacle to be overcome.

To install a connection at the power plant would not have solved the distribution problem. However, by locating the installation at the opposite end of the campus, it would be easy to pick up all the load supplied by the several small connections and at the same time provide needed capacity near a load center 2,000 ft. distant from the power plant, where it was most needed and most difficult to deliver from the plant. It was therefore suggested that the connection be made there and that existing feeders be used to supply the load in this vicinity. This could be done because the lines were so separated that a few minor changes made it possible to separate the lighting load from the power load.

A HINT ON HANGING "LIGHT-HOODS"



Curtis Lighting

This practical method has been suggested for mounting the new continuous indirect lighting units or "light-hoods" at a uniform height above the working surface in industrial plants where ceilings are high or where roofs are supported by trusses running either parallel or perpendicular to the light-hood. Maintenance of uniform mounting height is imperative for efficient operation of these units, whether they are 5 or 300 ft. long.

•

Color-Display Lights Send Demand Soaring

By CHARLES R. RIGGLE
Ohio Edison Company, Youngstown

Study of the daily load curves for a large theater that had reported a high power bill revealed that at two-hour intervals the demand increased excessively for a fifteen-minute period. These periods corresponded exactly with the intermission when an elaborate display of lighting effects was made. This display, composed of multiple colors, blended and shaded, was effected by bringing the various colored lights simultaneously up to full brilliance and then dimming them. On first thought it would not appear that this would cause an appreciable increase in demand. However, the connected load on this display actually raised the demand about 70 kw.

Power salesmen of the Ohio Edison Company recommended that each color be brought up separately to maximum brilliance and dimmed, displaying the various colors in sequence. This enabled the management to continue to use the display of colored lights during intermission, but with only a small increase in demand.

"HANG THE LOAD ON HUBBARD HARDWARE"

PHOTO BY N. E. S.

IN Mexico, at the markets, Indians gather by the hundreds to offer their wares for sale. They deal in peppers, oranges, fowl, silverware, pottery, leather goods and many other products. Their sales methods are born of a long experience which has taught them that a lavish display leads to the best results. A pause at their stands invariably results in the sudden materialization of a silver bracelet or possibly a slender, horn handled machete dangling before your nose. You may find a pair of woven leather sandals in your hands, placed there by some mysterious means. Articles of interest are handed to you from all sides to be *examined* as closely as you choose.

A valuable asset, this method of selling, one which you as the Public Utility man and the producer of an invisible commodity, cannot utilize. It is impossible for the housewife or factory owner to handle your product, weigh it, and judge its quality. You must sell your product, Electric Current, on the basis of uninterrupted operation and service—an abstract qualification which can be SOLD WITH ASSURANCE when you know you are backed by HUBBARD HARDWARE.

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Building Up THE LOAD

New ideas and practices in selling electrical equipment and service to commercial and domestic customers

Off-Peak Power for Hospital Heating

In a recent issue of *L'Electrique* some particulars are given of the heating arrangement which has been adopted at the Isle Hospital in Berne, Switzerland. During off-peak hours and during the summer months a large quantity of surplus power is supplied to the hospital for heating, the authorities of the latter agreeing to use only electricity in place of coal or other solid or liquid fuel during the six summer months.

During the winter the generating station supplies any surplus power that may be available, at the same rate off-peak as charged during the summer.

In connection with the arrangement, which has now been in use for some time, a 6,800-kw. electric boiler and two 22,000-gal. steam accumulators were installed at the hospital. Records show that 13,500,000 kw.-hr. is consumed in twelve months, resulting in a saving to the hospital of 2,000 tons of coal.

•

Desks Receive 40-50 Ft.-Candles

In rebuilding a portion of its Lincoln Square shop to serve as an accounting department office the Morgan Construction Company, Worcester, Mass., installed combination mercury vapor-tungsten lamps to provide from 40 to 50 ft.-candles on the desks. The units (G.E.make) are mounted on approximate 10x12-ft. centers and ten were required for the 25x65-ft. office, which has a height of about 10 ft. The unit ratings are based on the use of four 100-watt incandescents and one 600-watt mercury tube. Trial installations of one unit each have been made in adjacent offices with satisfactory results.

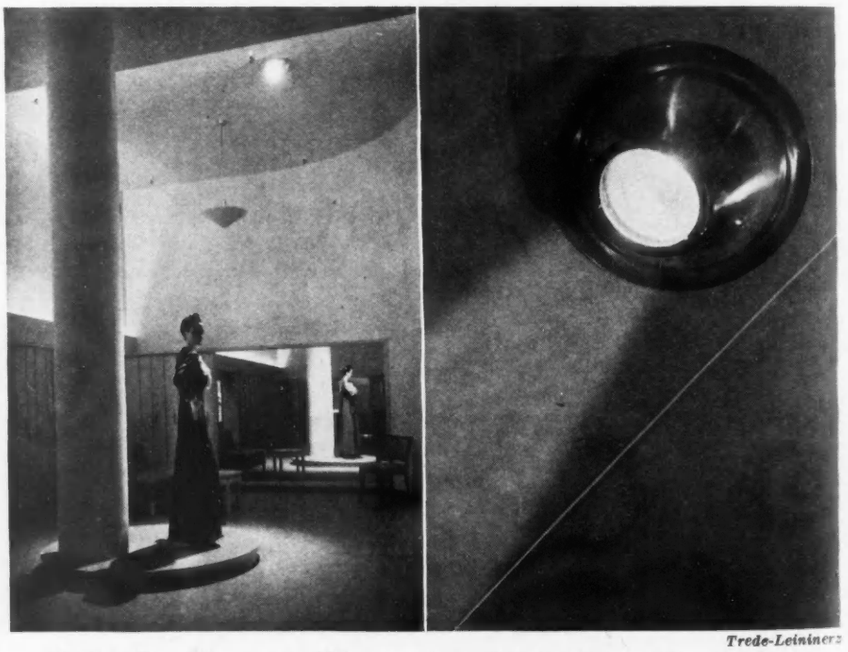
•

Theatrical Light for Store Interiors

About a year ago a soft edge spotlight, known as the "Fresnelite," was announced as a new development for lighting store window displays. Essentially a theatrical device, the unit was adapted for the store-lighting field to help dramatize merchandise displays.

Now the maker of the device, Century Lighting, Inc., has announced a variation of the unit for interior use in lighting free standing displays. In either recessed or surface mounting types, the "Ceiling Fresnelite," as it is called, makes use of a spherical, universal angle mounting, which projects the beam from a 500-watt T-20 lamp in all directions up to 32 deg. from the vertical. A 6-in. "Fresnelens" (step lens) is used; provision is made for use of a color glass holder. At a mounting height of 15 ft. the unit is said to provide 100 ft.-candles of illumination.

First installation of the new unit was made in the Little Shop of R. H. Macy's in New York City and found such favor that the store now has 26 of the units installed throughout its building.



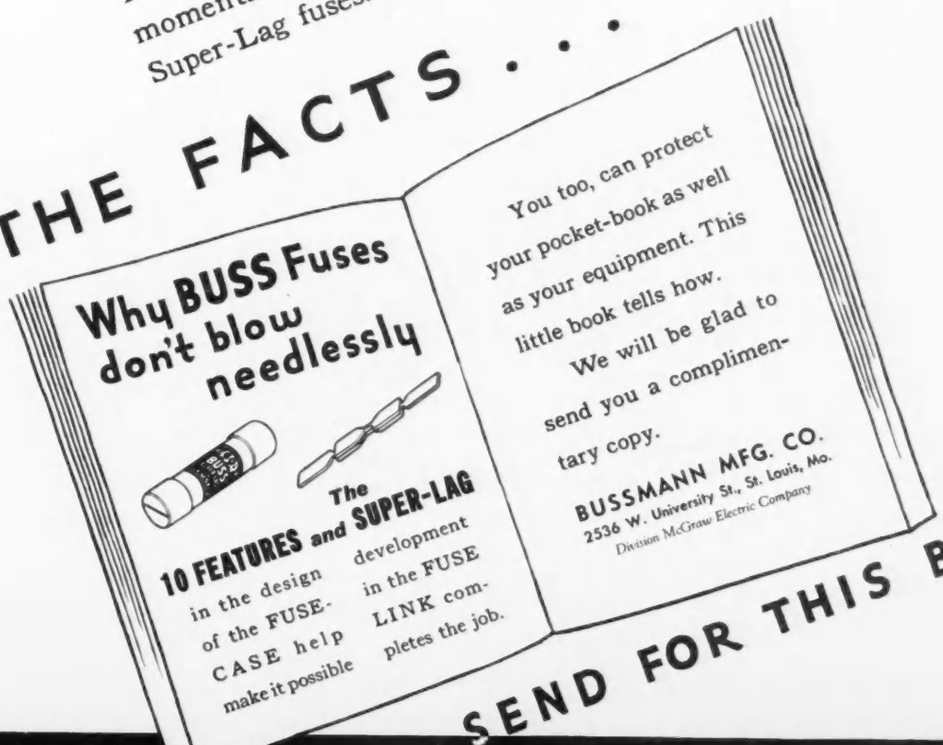
Trede-Leininger

Ceiling Fresnelite, a new 500-watt unit for lighting free standing displays in store interiors

— AND HERE'S HOW"

says Mr. A. Pollock, Ch. Electrician Congoleum-Nairn, Inc., Kearny, N. J. "We have to shut down our two roll sheeter several times every day to prevent sheets piling up on the next operation. Starting it again throws a heavy overload on the motor as the plastic material going thru begins to harden as soon as the machine stops. Ordinary 100 ampere 600 volt fuses were blowing about twice a week on this momentary overload. About June 15th, 1932 we installed BUSS Super-Lag fuses. They completely wiped out our fuse difficulties."

GET THE FACTS . . .


Why BUSS Fuses don't blow needlessly
10 FEATURES and The SUPER-LAG in the design of the FUSE-CASE help make it possible development in the FUSE LINK completes the job.
You too, can protect your pocket-book as well as your equipment. This little book tells how. We will be glad to send you a complimentary copy.
BUSSMANN MFG. CO.
2536 W. University St., St. Louis, Mo.
Division McGraw Electric Company

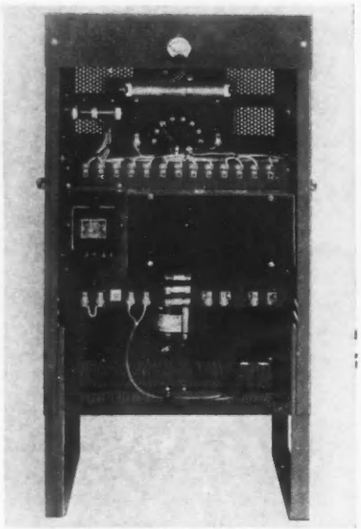
SEND FOR THIS BOOK

Super Lag FUSES

New EQUIPMENT AVAILABLE

Automatic Battery Charger

This unit has been designed for the automatic charging of batteries used for control bus (oil switch operation, emergency lighting, etc., in central station and private plants) and similar services. It consists of a fan-cooled copper oxide rectifier controlled by the company's "TVR" voltage relay, an electromagnetic contacting device, said to be self-compensating for ambient temperature variations. Through a synchronous time switch the rectifier automatically puts the battery on charge at definite intervals, usually once every hour. When a complete state of charge is reached the charging is automatically discontinued.

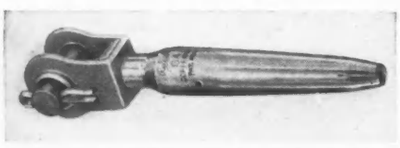


"Exide" TVR relay-controlled, fan-cooled copper oxide rectifier; for use with 60-cell storage batteries having eight-hour capacities of from 80 to 240 amp.-hr. **Electric Storage Battery Co.**, Philadelphia.

•

Dead-End Splice

Especially designed for type A Copperweld wire is a new dead-end splice recently offered. As in the straight-line splice recently announced by this company for the same composite conductor, the jaws that grip the wire have a long surface to insure firm hold on this three-strand cable with its characteristic long lay. Gripping power of this splice is said to be so great that under test it breaks the wire at its full strength.



Dead-end splice; in three sizes: for 8A, 6A and 4A Copperweld. **Reliable Electric Co.**, Chicago.

•

Window Type Safety Switch

To provide for quick and easy inspection of the blades from the outside, this company has added a window type to its line of mill duty safety switches. Of 3/16-in. shatter-proof glass, the window is cushioned by a sponge rubber gasket. Like other units in the standard line, these switches are characterized by quick make-and-break mechanism, pressure-type fuse clamps, non-current carrying hinge posts, double-break air-blanketed contacts, silver-plated blades and jaws unit pole construction and interlocked cover with key release and provisions for padlocking.

Bulletin 4101; standard sizes from 30 to 1,200 amp. up to 600 volts, fusible and non-fusible. **Cutler-Hammer, Inc.**, Milwaukee.

•

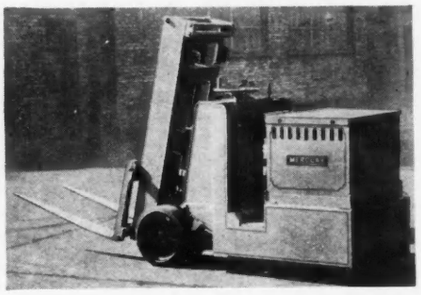
Insulated Link

Insulated link. **James R. Kearney Corp.**, St. Louis.

A newly developed insulated link is used in conjunction with the maker's "Hi-Line" tools in live line maintenance work and is a safety device for holding conductor away from men working on pole. This link also provides insulation between pull-off ropes and the conductor. Company's engineers recommend links, when clamp heads and swivel butts are installed on oak poles at the factory, for safely working loads up to 5,000 lb. Laminated oak poles 1¾ in. in diameter and in 2 and 4 ft. lengths are standard; head of link is tightened by rotating pole and will go over ⅝-in. diameter conductor.

Telescopic Fork Truck

New tilting telescopic fork truck is a two-wheel, front-wheel drive, two-wheel, rear-wheel-steer unit, of center control type. Fork elevation is hydraulically actuated, the forks traveling from a lowered position of 1¾ in. above the ground to a height of 107 in., with an elevation of 144 in. available. Forks are adjustable center to center; steering mechanism is of the Ross cam and lever type. Truck has a travel speed of 5½ m.p.h. light and approximately 5 m.p.h. with full load.

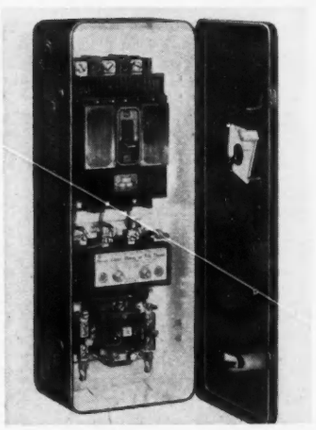


Type A-1043; four-wheel base sizes: 50, 54, 60 and 66-in., latter with max. capacity of 10,000 lb. on 36-in. long forks. **Mercury Mfg. Co.**, Chicago.

•

Combination Starter

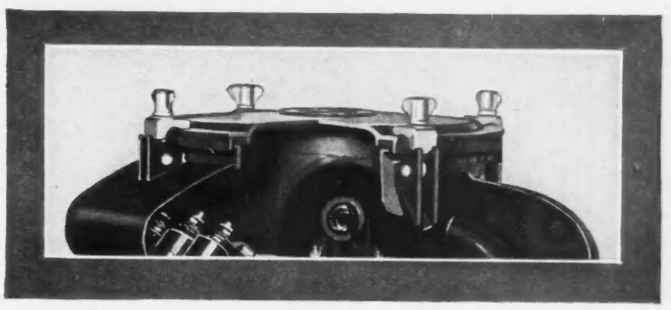
In this new combination starter circuit breakers replace the standard disconnect switch. Automatic starting switch is of the solenoid type, with double-break, silver-alloy contacts and two thermal overload relays. Circuit breaker is inclosed in molded Bakelite case and has three poles operated by single lever. It can be tripped open or

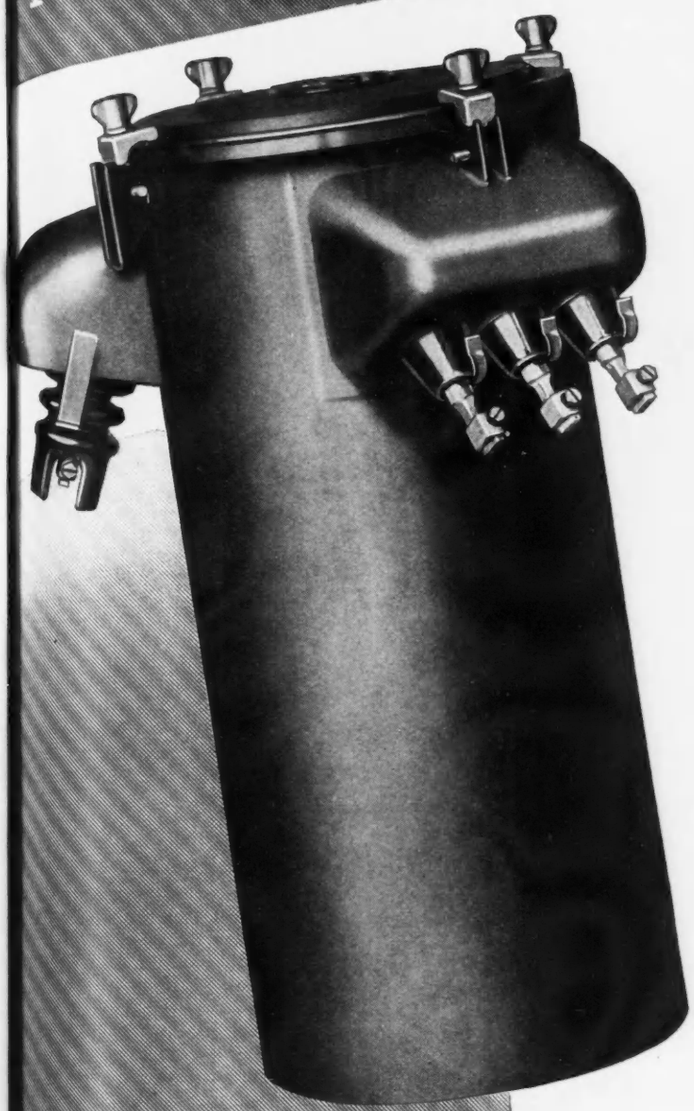


"Bulletin 713;" maximum rating, 30 hp., 220 volts; 50 hp., 440-550 volts. **Allen-Bradley Co.**, Milwaukee, Wis.

YOU PROFIT FROM THIS ADVANTAGE

OIL-TIGHT COVERS..





Take off cover . . . change taps or inspect . . . put cover back in place . . . the gasket will not tear or distort . . . the seal will be oil-tight *at all times.* No dirt, no moisture can get in. L-M transformers are sealed with four sturdy rust-proof cap wing nuts clamping gasket firmly against rolled tank edge. The rigid cover will not dent or bend out of shape. The rust proof clamps and nuts will never "freeze."

This oil-tight cover is just one of the many advantages you will find in L-M Distribution Transformers. For complete information ask your L-M Representative, or write LINE MATERIAL COMPANY, So. Milwaukee, Wis.

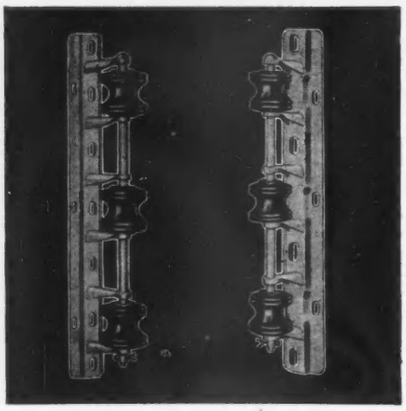
L-M DISTRIBUTION TRANSFORMERS

LM

OLIVER

Pole Line Material

PERFECTED PRODUCTS OF OVER FORTY YEARS OF ENGINEERING AND RESEARCH



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Pioneering in the design and manufacture of Pole Line Materials since 1894, Oliver engineers are still pioneering—still constantly improving their products to meet the ever increasing demands of modern electrical power transmission and distribution systems. Get the benefit of these improvements by specifying Oliver for *your* pole line requirements.

OLIVER IRON AND STEEL CORPORATION

PITTSBURGH · PENNSYLVANIA

OLIVER POLE LINE MATERIALS

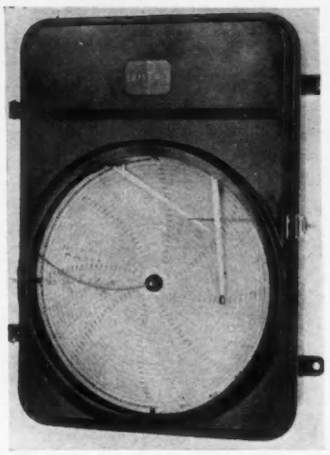
APPROVED AND ACCEPTED SINCE 1894

closed in same manner as ordinary disconnect switch. However, an overload in any pole trips a bimetal thermal unit and opens breaker. All poles are also equipped with instantaneous magnetic trip.

•

Pyrometer Controllers

Close electrical control which is free from chattering at the contact points is said to be provided through this new pyrometer controller. Instead of continuously moving

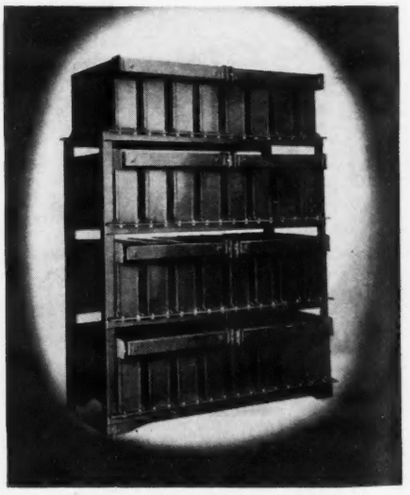


"Pyromaster" pyrometer controller; 12-in. cases; high, low, high-low, high-off-low and high-normal-low types of control offered. **The Bristol Co.**, Waterbury, Conn.

parts and trains of gears to be engaged and released, a series of relay-actuated switches, with a special wiring arrangement, is used to position pen arm on the instrument chart and to effect control. Controllers are equipped with special "Unitact" relays, which require making and breaking of only one contact to effect control.

•

Box-Type Capacitors



Box-type capacitors for power-factor correction; units completely assembled and wired, ready for connection to lines; assembly shown rated at 640 kva., 460 volts, three-phase, 60 cycles. **Cornell-Dubilier Electric Corp.**, South Plainfield, N. J.

•

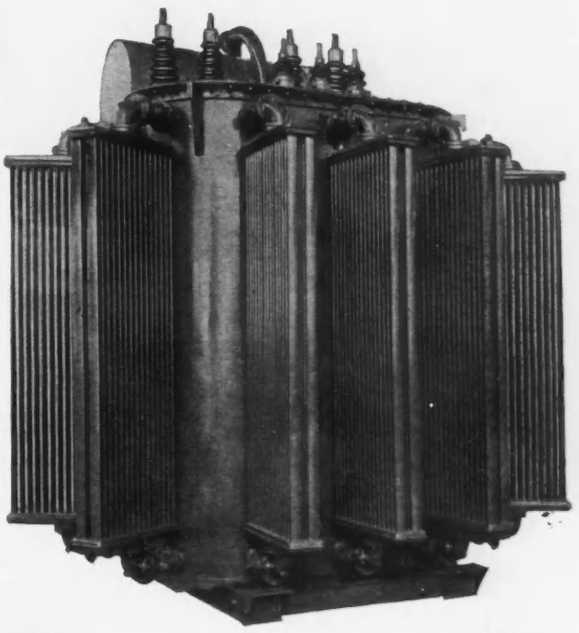
Immersion Heaters

Large heating surfaces and low temperature gradients are features claimed for new immersion heaters which are said to make

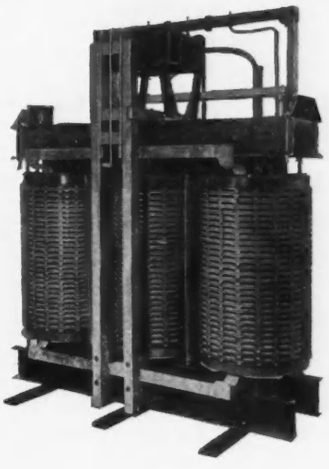
VALUE

Price is not a criterion of transformer value

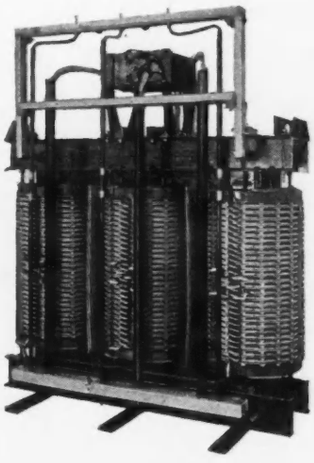
When purchasing transformers, the price quoted for a unit of given rating is only one consideration . . . electrical efficiency, stamina and special features frequently justify a considerable price differential. Cost is balanced against design advantages in the manufacture of AmerTran Transformers, so as to produce equipment offering the maximum value per dollar investment. Users find that these transformers not only meet their specifications but also that installation, operating and maintenance costs are exceptionally low. May we submit data on transformers for your requirements.



ABOVE
AmerTran Type CT three-phase power transformer for outdoor installation.



LEFT
Core-and-coil assembly of the above power transformer—showing low-voltage bus bar.



LEFT
View of core-and-coil assembly showing how high-voltage leads are taken from the section-wound coils.

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PRODUCTS

Transformers	Transformers
Power*	Distribution
Furnace	Instrument
Testing	Precipitation
Welding	Audio Frequency
Air-Cooled	Filament-Supply
Plate Supply	Special Purpose

Voltage Regulators
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* 10,000 Kva., 132 Kv. and smaller

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178 Emmet St. Newark, N. J.

There's only One Way!

THERE'S only one way to stop **wasted kilowatts** and **wasteful shutdowns** and that is to switch to a ***"different"*** fuse—a **powder-packed** fuse, and remedy those bad fuse clips. Then, and then only, will you obtain amazingly different results and **NOW,** if ever, is the time to do it.

KLIPLOK CLAMPS

Eliminate burnt fuses and clips, —unnecessary shutdowns and wasted current caused by overheating. KLIPLOKS **correct** bad clips and **protect** new clips. There's a size for every clip. USE **KLIPLOKS** EVERYWHERE!

Fully covered by U. S. Patents.

TRICO *POWDER-PACKED* FUSES

The renewal element is different—it's **self-contained, powder-packed,** positively **tamper-proof** and **non-interchangeable** with ordinary "bare links." The powder-packing **re-inforces** the fusible link—it cannot sag, stretch, lose its rated capacity, or become damaged in handling. It has a **safe** time-lag preventing early deterioration of motor windings. Nothing has been spared to make TRICO FUSES a safe, dependable, and lasting investment.

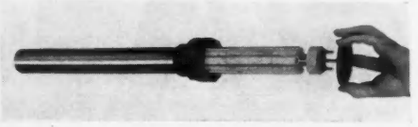
Look on the inside—that powder-packed Element is worth a million dollars—yet costs no more!

TRICO FUSE MFG. CO., MILWAUKEE, WIS., U.S.A.
In Canada—IRVING SMITH LTD., Montreal

TRICO REG. U.S. PAT. OFF. POWDER PACKED **FUSES**

STOP WASTED KILOWATTS AND WASTEFUL SHUTDOWNS

them ideal for those applications where there is a possibility of heavy lime or coke formation on the heating element. Another interesting feature of the heaters is that all parts are replaceable. New refills for the



"Weaco" immersion heaters; in two diameters, 1¼ and 2 in.; for 110 or 220 and for 220 or 440 volts, a.c. and d.c.; wattages from 500 to 3,000. **Warren Electric Appliance Co.,** Warren, Pa.

nickel chromium resistance wire heating elements may be purchased and used without dismantling the apparatus or new shells inclosing the elements may be bought if this part should become damaged. Standard knock-out box mounted in the top facilitates wiring.

•

Radio-Free Insulators

Supplementing its copper-coated radio interference-free pintype insulators, this company has brought out a complete line of these insulators with aluminum-coated heads

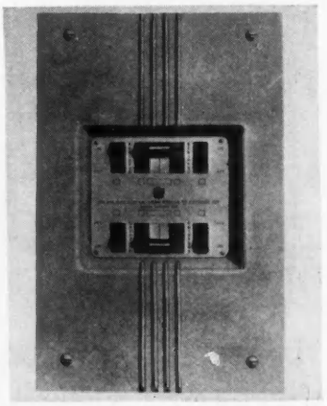
Aluminum-coated "Silentypes"; in five multipart sizes, with metal or sanded pinhole and three unipart sizes with metal pinholes. **Ohio Brass Co.,** Mansfield.

for those operators who prefer to use this type of aluminum conductors. They are said to have the same flashover values, leakage and arcing distances, mechanical strengths and positive adhesion of metal coating to porcelain as their copper-coated counterparts.

•

Load Centers

Swing-out interiors are featured in these "Nofuze" load centers. Both surface and flush-mounted types are offered, with as many as eight branch poles. Mains can be supplied in 35 and 70 amp. capacities, for



"Nofuze" load centers. **The Bryant Electric Co.,** Bridgeport, Conn.

Now! WE FLY..

The ox-cart or the horse and buggy do not meet the transportation demands of today. Now! we fly. . . .

. . . But no airplane of modern dimensions could be economically justified if it was not for the many advantages of the new, light-weight, high-strength metal alloys. These alloys have been designed especially for the job of reducing bulk and increasing strength – thus increasing possible payload. Conventional materials, those that we have known for years, have been relegated to the shelf and in their places we have accepted the newer, stronger, lighter, less bulky materials provided by modern scientific research.

It is to this latter group that Simplex-LATOX rubber insulation belongs. It was perfected in Simplex Laboratories to meet a definite need caused by modern day conditions. It was designed especially for the job of reducing bulk and increasing those physical and electrical properties necessary for efficient insulation – thus increasing possible payload or reducing capital investment.

Simplex-LATOX rubber insulation is waterproof, permanent and retains indefinitely the qualities of high-grade rubber insulation. It is made directly from pre-vulcanized rubber latex and is deposited on the conductor in a series of films to form a thin homogeneous wall of high-grade rubber insulation **containing not less than 93% rubber** and having uniform physical and electrical characteristics.

Simplex-LATOX is designed to provide small diameter, light-weight, moisture-proof cable for supervisory control of utility sub-stations, police and fire alarm, telephone and signal service and electric or steam railroad control or signal systems. It is the ideal insulation for communication, signal and control cables. For all such applications it combines the advantages of rubber and paper insulations yet exceeds but little the small diameter and light weight of dry paper insulated cables heretofore used.

May we send a booklet "LATOX Lead Covered Cables" giving more complete information? The coupon below properly filled in will bring it to you.

Simplex Wire & Cable Co., 79 Sidney St., Cambridge, Mass.

Simplex – LATOX

Light wall insulation made directly from rubber latex

Name_____

Company_____

Street_____

City and State_____

EW 1-15

OVER $1,000,000 LOST

Annually by One Company ALONE . . .

THROUGH CURRENT DIVERSION

Meter Racket Exposed by New York Utility

A six-year search to uncover a clever and profitable racket, which saved large electric customers thousands of dollars a year, was revealed this week in New York when Walter Laurence, Jr., was held in $5,000 bail in Yorkville Court.

Consolidated Edison Company of New York, Inc., estimated that it lost about $1,000,000 a year through the scheme of turning back meters. John J Holland, chief of the property protection department of the utility, declared that the company had watched the racket develop for twenty years, but that it had been impossible to get enough evidence for an important arrest.

It was pointed out by Mr. Holland that clever counterfeit seals were made to replace the broken company seals. Shunts and other methods uncovered were considered crude to the one employing counterfeit seals.

•

Plant Reopens

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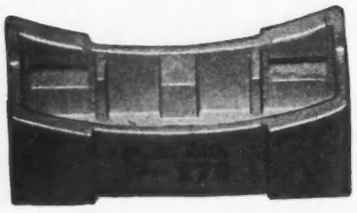
THIS RACKET CAN BE STOPPED

EFFECTIVELY and PERMANENTLY BY USING



STAR METER SEAL

Why tolerate enormous losses when, for negligible cost per meter, they can be entirely eliminated. Once in place, this porcelain cap cannot be removed without badly mutilating or destroying it—a sure trap for the power thief. STAR METER SEAL fits all types of CS meters.

SEND FOR SAMPLE

Address Meter Seal Dept.

The STAR PORCELAIN COMPANY
TRENTON NEW JERSEY

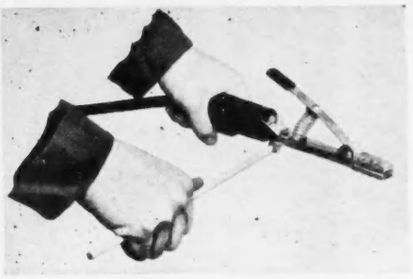
MAKERS OF ELECTRICAL PORCELAIN SINCE 1899

two-wire, 115-volt, or three-wire, 115/230 volt solid neutral a.c. service. Branch breakers are provided in various combinations of 15, 20, 25, 35 and 50 amp. capacities.

•

Welding Electrode Holder

Light weight has been obtained without sacrificing quality in this new arc welding electrode holder, it is claimed, through the



"Type ST"; weight 14 oz., capacity 250 amp. continuous. **Lincoln Electric Co.**, Cleveland.

use of formed steel parts, electrically welded. Connection to cable is made by a special clamp which locks cable to electrode holder. Clamp can be tightened or loosened without tools by inserting a welding electrode through hole in square head of clamp cap screw and applying leverage.

•

Pulley Lagging

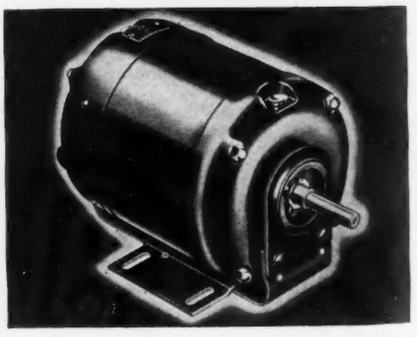
Industrial plants wishing to increase the capacity of some motor-driven machine or correct a too-small motor pulley may be interested in a new fiber lagging used to increase diameter of pulleys and flywheels. Increasing diameter of driven pulley permits increasing size of motor pulley and results in higher belt speed, hence provides for reduced belt tension. Laggings are clamped on wheel rim.

Fibre lagging; in any width and up to 72 in. in diameter. **Rockwood Mfg. Co.**, Indianapolis.

•

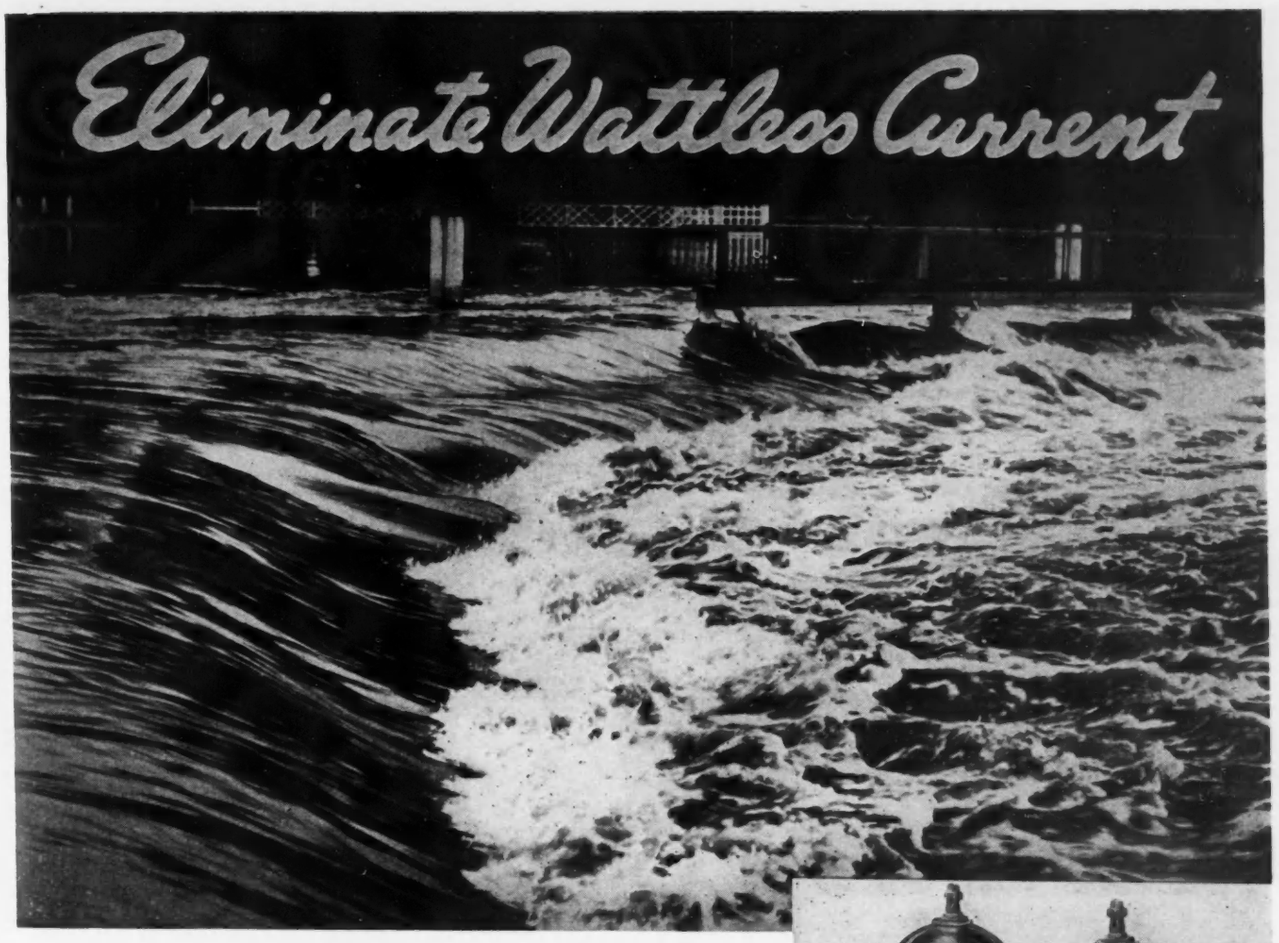
Fractional Size Motors

Even the terminal boards of a new line of fractional size motors are self-contained; end bells are smoothly rounded and cover bearings and oil wells, starting switch and fan, and also capacitor and thermal protective device if required. Standard solid base,



Resilient-mounted type shown; line ranges from 1/8 to 1/3 hp., for 900, 1,200, 1,800 and 3,600 r.p.m., also for two-speed operation in split-phase or capacitor models. **The Ohio Electric Mfg. Co., Cleveland.**

resilient-mounted and belt-tightening types are offered. The belt-tightening motors are so mounted that weight of motor provides initial belt tightening effect.

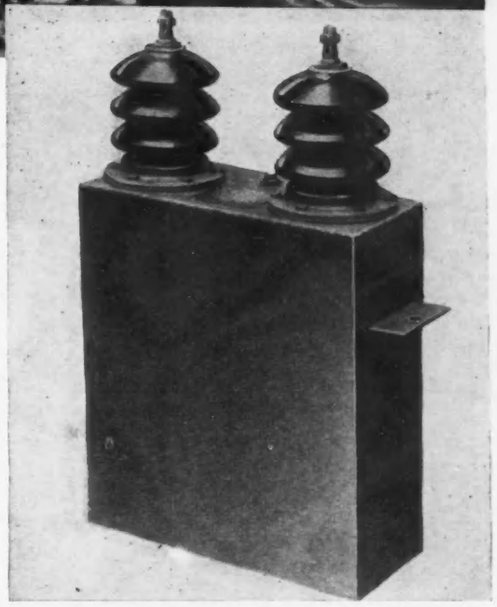


Get more system capacity with C-D CAPACITORS

Not so many years ago, when increasing power demands overflowed available distribution facilities, it was necessary to cut new lines or rebuild old ones to ease the floodload on feeders. This was extremely costly.

Today, power companies are discovering in C-D capacitors the economical answer to their load problem. C-D's enable you to handle more pay load at a fraction of the cost of new equipment. Lowered copper losses and increased revenue made possible by voltage correction permit amortization of capacitor cost, in many cases, in less than one year.

Investigate the money saving possibilities of C-D capacitors today! Complete details sent on request. Cornell-Dubilier Electric Corporation, 1032 Hamilton Blvd., So. Plainfield, New Jersey.



One or two bushing (optional) pole-mounting unit. May be mounted singly or in groups with simple pole-mounting bracket.

CORNELL DUBILIER

World's Largest and Oldest Exclusive Manufacturers of Capacitors

Capacitors for Power-Factor Correction

News ABOUT PEOPLE

R. A. McCarty of Westinghouse in Lima; Stohr Promoted

R. A. McCarty has been appointed manager, small motor division, Westinghouse Electric & Manufacturing Company to succeed R. F. Frenger who

R. A. McCarty

F. H. Stohr

has returned to East Pittsburgh to the vice-president's staff for other special duties. Mr. McCarty will have his headquarters in Lima, Ohio.

A graduate of the University of Tennessee, Mr. McCarty started as a tester and then entered the power engineering division in 1906, three years later being assigned to motor engineering. In 1910 he was made engineer in charge of insulation design and became section engineer a year later in the power engineering department. After serving as division engineer and manager of power engineering department, Mr. McCarty was named manager of the generator division.

F. H. Stohr succeeds Mr. McCarty as manager of the generator division with headquarters at East Pittsburgh. Formerly manager of generator sales, Mr. Stohr joined the company in 1922 and has held various positions in connection with the negotiation work on power apparatus. He is a graduate of the University of Iowa.

•

▶ ROLLIN N. CONWELL, formerly transmission and substation engineer in the electric distribution department of the Public Service Electric & Gas Company, Newark, N. J., has been promoted to the position of transmission and distribution engineer.

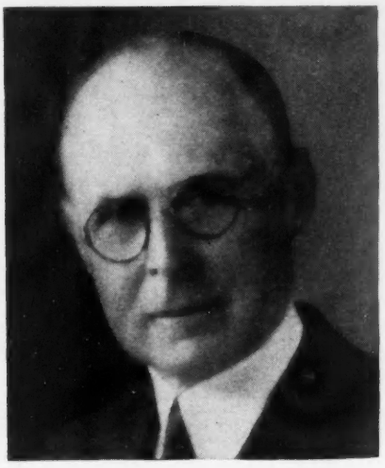
▶ FLOYD L. CARLISLE and OSCAR H. FOGG have been elected chairman and vice-chairman, respectively, of the Yonkers Electric Light & Power Company and Westchester Lighting Company. Mr. Carlisle and Mr. Fogg hold similar positions in the Consolidated Edison Company of New York, Inc., parent company of the Yonkers and Westchester units.

▶ J. R. A. HOBSON, project engineer for the PWA on Danville's hydroelectric plant in Patrick County, has been named project engineer for the High Point power plant project on the Yadkin River. He will maintain his offices in Danville and will divide time between the Danville undertaking and the Yadkin River power development.

Chemical Society Presents Perkin Medal to Dr. Tone

The Perkin Medal for 1938 was presented last week to Dr. Frank J. Tone, president of The Carborundum Company, at a joint meeting of the American section of the Society of Chemical Industry and the American Chemical Society, held at The Chemists' Club, New York.

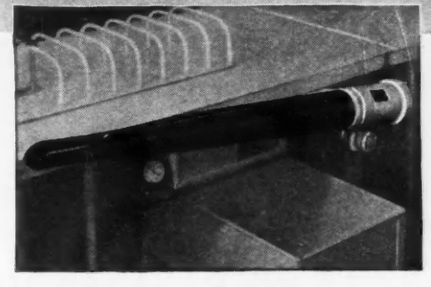
Dr. Tone's connection with the chemical field dates from the inception of Niagara power in 1895 when he became associated with Dr. Edward G. Acheson in the development of "carborundum" as works manager and later as president of The Carborundum Company at Niagara Falls. He became one of the pioneers not only in the development of electric furnaces on a large scale, but also in the new abrasive art which began with electrothermally produced abrasives. His outstanding contribution in the electrometallurgical field was the development of a large scale process for producing silicon metal, now widely used in making alloys of aluminum and steel and as a reducing agent in the



F. J. Tone

[*Continued on page 156*]

1,202,240 STITCHES PER STOCKING



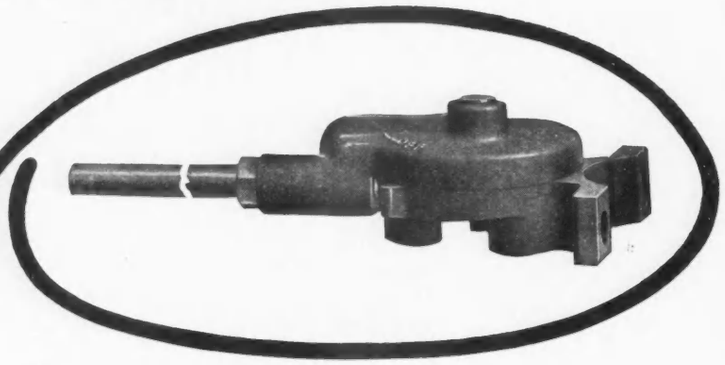
SYNTHANE makes it possible for the manufacturer to scan the 1,202,240 stitches of a sheer silk stocking in the twinkling of an eye. . . . *Synthane* Bakelite-laminated is used in stocking examiners because it has three desirable properties in *combination*—smoothness, solid color, and wear resistance. . . . You can get this same combination of properties or almost any other combination you desire in *Synthane*, for *Synthane* has an unusually broad *combination* of physical, electrical, chemical and mechanical properties. *Synthane* is a dense, solid material, tough, strong and light in weight—an excellent electric insulator—with a low power factor, low moisture absorption, high dielectric strength and low dielectric constant. It's chemically inert and corrosion resistant. It machines easily. *Synthane* is often the most *economical* material to use through lowered production costs, better product performance, dependable adherence to standards. Why not write for data on *Synthane*, giving us your requirements?

SYNTHANE CORPORATION, OAKS, PENNSYLVANIA

SHEETS • RODS • TUBES • FABRICATED PARTS • SILENT STABILIZED GEAR MATERIAL

SYNTHANE
Bakelite— laminated

BETTER CONTROL THAN EVER——



OVER WINCH LINE LOADS
WITH A VACUUM CLUTCH WINCH

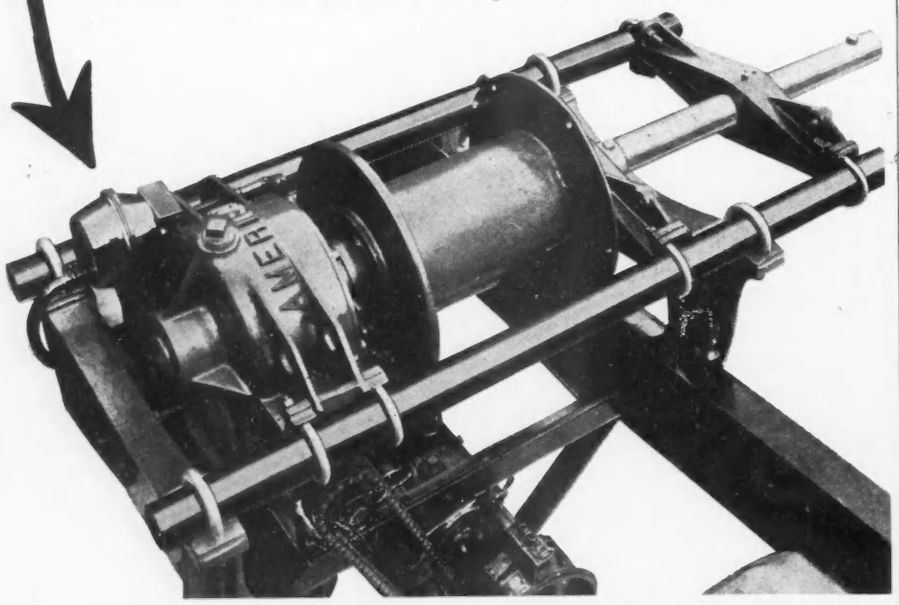
NEW AMERICAN SERIES 75 CB WINCH gives positive control and flexibility of operation under all conditions. It is designed for greater capacities and ample allowance is made for intermittent overloads.

A VACUUM CLUTCH AND FREE DRUM BRAKE is operated from the dashboard. The driver no longer reaches through the cab window to levers on the winch.

The POSITIVE LOCKING CLUTCH will not disengage while there is a load on the line.

An AUTOMATIC WORM BRAKE insures positive irreversability at all times.

And in addition, it has adjustable hangers and a removable shaft extension. Its tubular cross supports reduce the strain on the frame and prevent tilted I beams.



The American Series 75 CB Winch presents a new departure in winch design.

THE AMERICAN COACH & BODY CO.
CLEVELAND, OHIO

manufacture of low carbon ferro alloys.

Dr. Tone was awarded the initial Jacob F. Schoellkopf Medal by the American Chemical Society and the Edward Goodrich Acheson Medal by the Electrochemical Society.

•

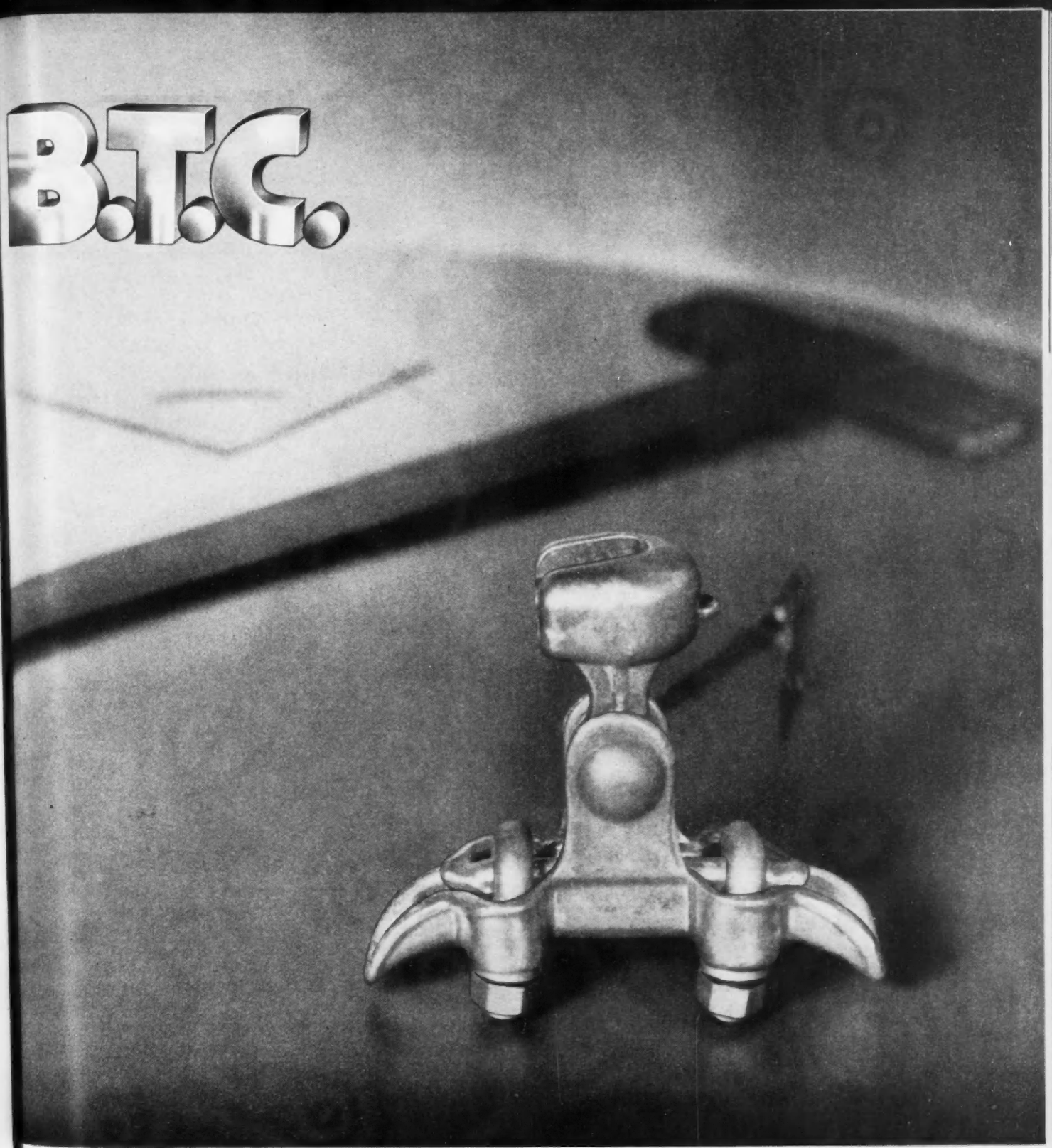
▶ H. HOBART PORTER, chairman of the board of the American Water Works & Electric Company, has been elected a life trustee of Columbia University. Mr. Porter succeeds Stephen Baker, honorary chairman of the board of directors of the Bank of Manhattan Company, who resigned recently. Mr. Porter was graduated from Columbia in 1886.

▶ EARL WALL has been appointed manager of the Memphis division recently formed by the Tennessee Valley Authority. The Memphis division office will serve as headquarters for electrical activities in west Tennessee and north Mississippi, with district offices remaining at Tupelo, Miss., and Jackson, Tenn. H. G. WILLIAMS of Chattanooga will succeed Mr. Wall as head of the Tupelo office.

▶ JAMES W. RICKEY, who supervised the construction of hydro-electric plants for the Aluminum Company of America since 1907, has retired. JAMES P. GROWDON, his assistant for twelve years, has succeeded him. Mr. Rickey will continue as consulting engineer.

▶ FRED C. TAYLOR has resigned as superintendent of production for the El Paso Electric Company, a Stone & Webster unit. He has been transferred to the construction division of Stone & Webster, Inc., Boston, Mass.

▶ JOHN F. CUNNINGHAM, supervisor of production for the General Electric Company since 1931, has been appointed assistant to the vice-president in charge of manufacturing, succeeding MYRON F. SIMMONS, who is retiring. Mr. Cunningham started with General Electric's armature department in 1901 at Schenectady. Subsequently he served in the motor department, test department, turbine production department, contract section and as assistant to the production manager of the works. Then he was transferred to the staff of H. F. T. Erben, then manager of the works, to follow important government con-



Drop Forged Hi-Line Hardware . . .

If it is standard Hi-Line hardware, you will find it in the BTC catalog. If it is special hardware, you will find the BTC engineers ready to cooperate in every way. In short, you will find that every possible problem in Hi-Line hardware can be met with a forging. Ask your insulator manufacturer.

Sold Through Your Insulator Manufacturer only

THE BREWER-TITCHENER CORPORATION
Cortland, New York

ELECTRICITY'S CONTRIBUTION
TOWARD BETTER LIVING AND WORKING CONDITIONS

Electricity's stake in modern heating, ventilating and air conditioning is indeed large. That's why men in the electrical field should be especially interested in the forthcoming International Heating and Ventilating—AIR CONDITIONING—Exposition.

Utility engineers, executives and commercial men will find it extremely advantageous to visit this exposition. Here will be seen the latest developments in equipment for controlling the temperature and air condition in industrial plants, institutions, commercial establishments, public buildings and dwellings.

In planning your load building activities for 1938, give full consideration to the tremendous potential new business offered by air conditioning. It will pay you to be fully posted on the latest equipment developments in this active field.

See and study the exhibits of 300 leading manufacturers at this outstanding exposition. You will benefit from the actual demonstrations of the latest equipment for modern heating, ventilating and air conditioning.

BE SURE YOU ATTEND,
and bring your associates!

The Air Conditioning Exposition

5th INTERNATIONAL HEATING & VENTILATING EXPOSITION

GRAND CENTRAL PALACE • NEW YORK, N. Y.

Under the Auspices of American Society of Heating & Ventilating Engineers

8000

tracts. In 1923 he became assistant production manager of the works and five years later was named assistant supervisor of production for the entire company. He was appointed supervisor in 1931. Mr. Simmons, who has retired, served as assistant to the vice-president in charge of manufacturing since 1928. He entered the service of the company in 1903.

OBITUARY

Howard C. Foss

Howard C. Foss, president of the Savannah Electric & Power Company, Savannah, Ga., died in that city January 9 after a heart attack He had been ill but a brief time His age was 58. Mr. Foss first became identified with the Savannah properties in 1912 as superintendent of the old Savannah Electric Company, later that year becoming general manager. In 1921 the Savannah Electric & Power Company was formed and Mr. Foss was made president.

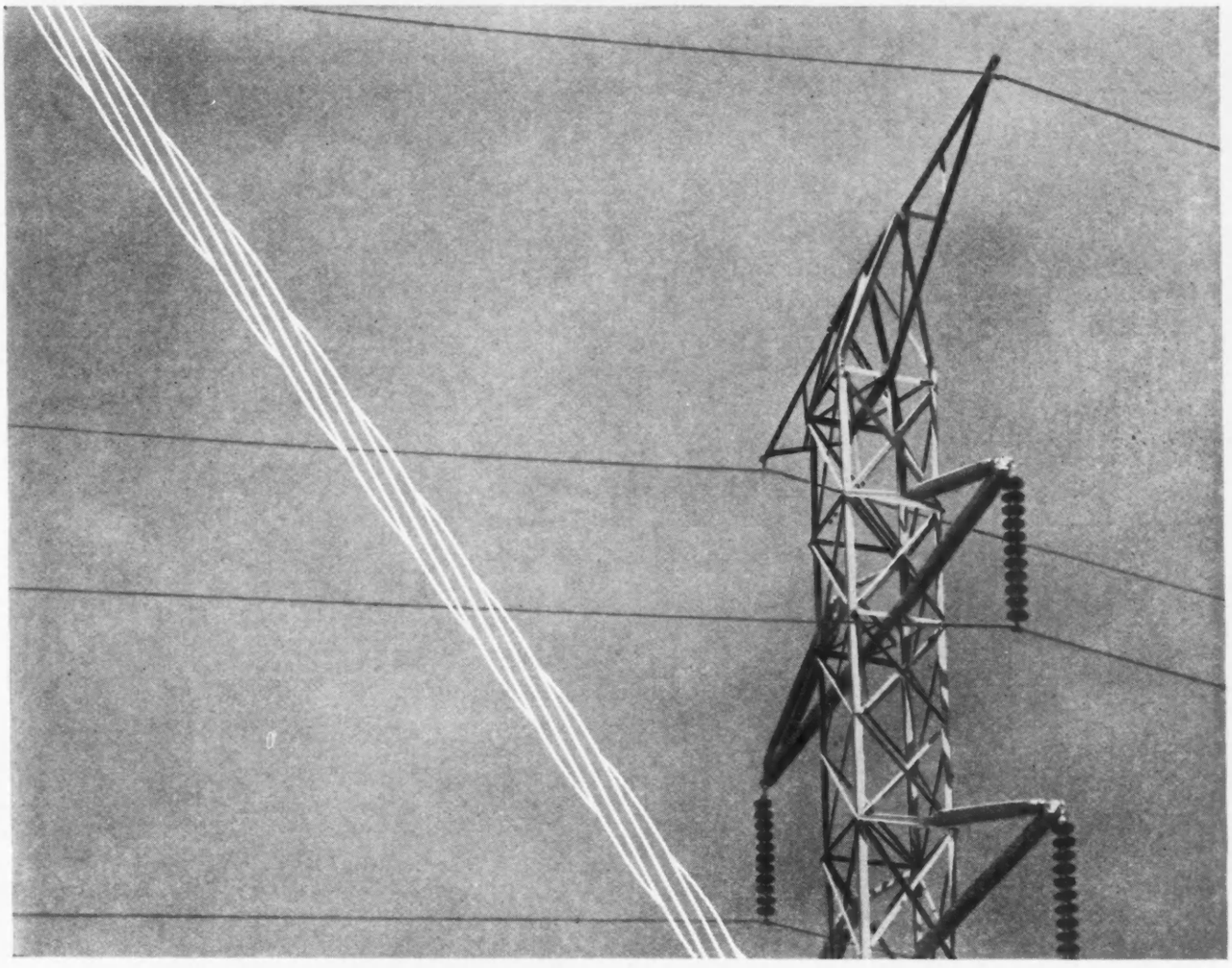
A native of Maine and a graduate of the University of Maine, Mr. Foss became a student engineer with Stone & Webster in Boston in 1905, the year of his graduation. He was then sent to Paducah, Ky., to be superintendent of the electric company there. From there he was transferred to Cape Breton, Canada, and Sydney and Grace Bay, Canada, to manage properties and later he went to Savannah.

In 1928 Mr. Foss organized the Industrial Committee of Savannah and had since served as its chairman. Mr. Foss was the recipient of the Lucas trophy for 1930, an annual award for the most meritorious service rendered the city by one of its citizens. Under his able direction Savannah Electric & Power Company made rapid progress.

•

JOHN A. CAPP, engineer of materials associated for more than forty-five years with the General Electric Company, died January 6 in Schenectady after a brief illness. He would have been 68 years old this week. Mr. Capp was widely known for his work in the field of testing metal materials. Trained under the late Professor Elihu Thomson at Central High School, Philadelphia. Mr. Capp, following graduation from the University of Pennsylvania in 1891, became asso-

It's **KNOW HOW** *that counts*



in making **Strand**

And there's plenty of "know how" back of Bethlehem Strand—the accumulated experience of half a century of strand manufacture by Williamsport Wire Rope Company, recently acquired by Bethlehem.

Take ground wire as an example. High-strength steel, possibly, may be specified. And 7-wire strand, double galvanized. Even with standard specifications covering these three points, Bethlehem (formerly Williamsport) Ground-Wire Strand has won high favor among utilities and transmission-line construction men.

"Know-how" has enabled Bethlehem to improve wire joints, for instance. Often such joints are so brittle as to snap as the strand is being strung. Bethlehem uses a time-controlled, low-temperature type of welding that produces an amply strong joint and at the same time hardly affects the cold-drawn wire on either side. Gone are the sharp changes in steel composition caused by sudden flashing and cooling—and gone is the weakness and brittleness so often found in wire joints.

A small point, perhaps. Yet wire joints are the most vulnerable point when stringing ground wire. With Bethlehem strand, these joints are no longer a problem.

Whether it's ground wire, messenger strand, or Form-set (preformed) guy wire; whether it's galvanized or bethanized (electrically coated), you'll find this "know how" invariably present in Bethlehem Strand.

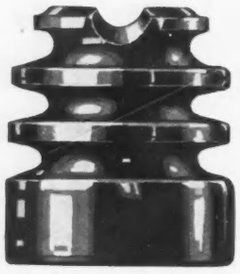
BETHLEHEM STEEL COMPANY

THOMAS "New Style" Pin Types

No. 233

No. 266

No. 277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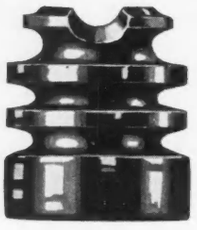
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Catalog Number	Nominal Rating	Flashover Kv. Dry	Flashover Kv. Wet	Leakage Distance	Pin Hole	Net Wt. Per 100	Standard Package
233	4400	35	23	4"	1"	75 lbs.	50 box
266	6900	55	35	6"	1"	125 "	50 box
277	13500	65	40	7½"	1"	200 "	40 box
288	17500	75	45	9½"	1"	275 "	24 box
298	23000	90	50	13"	1"	525 "	24 box
299	23000	90	50	13"	1⅜"	525 "	24 box

Specify these for dependable low voltage service

Multi-Grooved, combining balanced design with great ruggedness, Thomas "New Style" Pin Types are unified by the single standard of highest quality Thomas wet process porcelain.

Five different sizes allow easier adaptability and ample choice of conductor sizes. Each design is thoroughly modern and every refinement developed by insulator research has been included . . . yet, these sturdy units cost you no more than others.

Write for complete information on Thomas "New Style" Pin Types

THE R. THOMAS & SONS COMPANY
ENGINEERS - MANUFACTURERS - DESIGNERS
Established 1873
LISBON, OHIO, U. S. A.
OFFICES: - NEW YORK - BOSTON - CHICAGO
GRAYBAR ELECTRIC CO., INC., Agents
Incorporated 1892

ciated with Professor Thomson in the Thomson-Houston Company at Lynn, Mass. In 1892 he joined the General Electric Company in Schenectady, investigating and testing materials for the purchasing department. It was out of his testing work that the testing laboratory was formed. He was its head until 1927 when this laboratory was merged with the Schenectady works laboratory. He continued as engineer of materials.

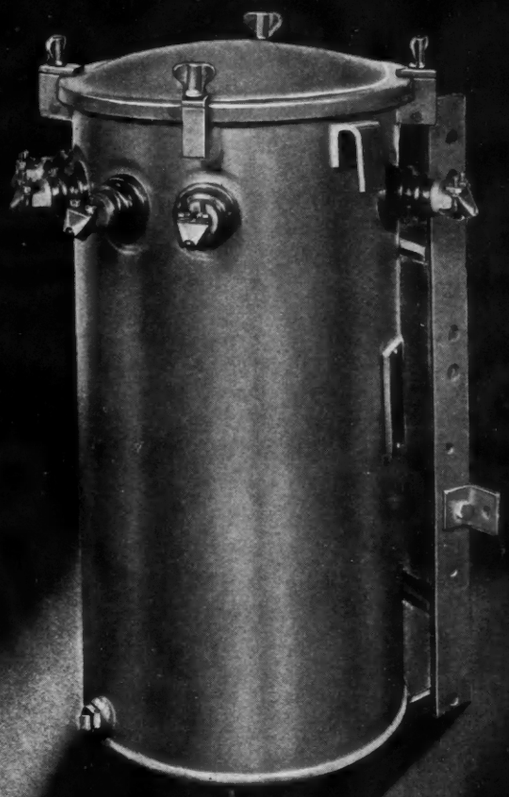
Mr. Capp was a founder of the American Society for Testing Materials, was its president for two years and was elected to honorary life membership last June. He had been chairman since its organization of the committee on copper and copper alloy wires for electrical conductors and his expert knowledge of tests and properties of non-ferrous wire products contributed to the development of standard specifications and methods for the entire industry. In 1918 he worked with representatives of other scientific societies in forming the American engineering standards committee which has since become the American Standards Association.

CHARLES B. CLENDENEN, Pacific division manager of the National Carbon Company, died in Los Angeles December 15 following an appendicitis operation. A native of Indiana, Mr. Clendenen joined the Prest-O-Lite Company in Indianapolis in 1910. In 1912 he was transferred to New York, eventually being made sales manager of the company. Upon the formation of the Union Carbide & Carbon Company in 1918 he was made assistant to the general manager of the National Carbon Company. He went to the Pacific Coast in 1921 as office manager at San Francisco, in 1926 was promoted to sales manager of the Pacific division and one year later was made Pacific Coast manager.

JAMES S. PHIFER, for the past twenty-seven years superintendent of the Allentown, Pa., plant of the American Steel & Wire Company, died recently of a heart ailment which had incapacitated him for several months. Mr. Phifer was 68 years old.

FRED L. ELLIS, superintendent of the Clinton, Mich., municipal electric light plant for 42 years, died December 21 in his sixty-fourth year.

Wagner DISTRIBUTION TRANSFORMERS



At the right is shown a new Wagner 15-kva, 2400-volt, type HEB stud-bushing-type distribution transformer. It has coordinated bushings and insulation and is self-protecting against lightning and, therefore, inherently a surge-protected transformer.

Whatever your distribution transformer requirements may be for the proper and economical distribution of electric power, whether in urban or rural regions, there's a Wagner transformer ideally suited for each job. Wagner distribution transformers are manufactured in all commercial frequencies and voltages in sizes 1½ to 500 kva.

Write today for Wagner's BIG Distribution Transformer Bulletin #180.

Wagner Electric Corporation

6400 Plymouth Avenue, Saint Louis, U.S.A.

TD 237-4B

TRANSFORMERS + MOTORS + FANS + BRAKES

Manufacturing AND MARKETS

Year Orders Higher for General Electric

Orders received by General Electric Company during the fourth quarter of 1937 showed a drop of almost 13 per cent from the same 1936 quarter, according to Gerard Swope, president. Fourth quarter orders totaled $73,997,063, against $84,857,181.

During the first nine months orders totaled $305,276,556, against $211,891,038 in the same 1936 period, a gain of 44 per cent. For all of 1937 orders totaled $379,273,619, as against $296,748,219 for 1936, an increase of 28 per cent.

Sales billed for fourth quarter are not yet available, Mr. Swope stated, but will be given in the annual report issued the latter part of March. However, sales billed for the first nine months of 1937 totaled $260,773,533, against $189,263,156 in the same 1936 period.

Mr. Swope pointed out that in every major department of the company, orders were greater in 1937 than in 1936. He said that the total number of employees was greater than a year ago, notwithstanding the reduction in the last few months, and that wages are still at the highest point in the history of the company.

In spite of increased cost of labor and materials, Mr. Swope said, improvements in design and better manufacturing methods had enabled the company to maintain the trend towards lower costs so that reasonable selling prices might stimulate an increased demand.

•

Exports of Machinery Rise

Exports of electrical machinery and apparatus in November amounted to $9,173,000 as against $7,602,000 in November, 1936. For the eleven months' period, these exports totaled $102,789,000 as against $83,135,000 in the corersponding period of 1936, according to the Department of Commerce.

Exports of household refrigerators in November numbered 9,362, valued at $758,000, compared with 10,037 valued at $646,000 in November, 1936. For the eleven months, they totaled 158,524, value $11,966,000, as against 153,391, valued at $11,176,000 in the corresponding period of 1936.

•

1937 Seen as Record Year for Vacuum Cleaner Sales

Domestic sales of electrical vacuum cleaners in 1937 will prove to be 10 per cent greater than 1936 and 12.5 per cent above next best year, 1929, when final figures are compiled, estimates the Vacuum Cleaner Manufacturers' Association.

The 1936 total was passed in November, 1937, and figure for year just closed will be almost 1,670,000, compared with 1,510,953 for 1936. Third quarter of 1937, traditionally lowest of any year, was characterized by a volume 30.8 per cent as great as total for all 1936, the association reports. Ignoring replacements, 1,670,000 vacuum cleaners represent an annual energy consumption of 40,000,000 kw.-hr., or annual revenue of around $8,000,000.

•

Worthington Adds Turbines

Worthington Pump & Machinery Corporation, Harrison, N. J., has acquired an interest in the Moore Steam Turbine Corporation, Wellsville, N. Y., it was announced by C. E. Searle, vice-president of Worthington. This extensive line of Moore steam turbine equipment will be added to the list of products sponsored by Worthington.

Air Conditioning Orders Drop 20%

Orders booked for air conditioning systems and equipment in November totaled $3,169,376, compared with $3,938,053 in October (a decrease of 19.5 per cent) and $3,834,240 in November, 1936, as reported by 125 manufacturers to the U. S. Department of Commerce. For the eleven months period, orders were $59,721,132, compared with $41,114,819 for the first eleven months of 1936.

Of these totals, orders booked by the air conditioning group in November were $1,011,072, against $1,285,305 in October and $1,144,572 in November, 1936 and totaled $30,804,351 for eleven months of 1937 as against $18,099,412 for the corresponding period of 1936.

For the fan group, these totals were $1,116,793, against $1,269,944 and $1,401,967; eleven months total were $18,179,691 as against $13,683,042. Finally, for the unit heater group, orders booked amounted to $1,041,511, against $1,382,804 and $1,287,701; eleven months totals, $10,737,090 against $9,332,365.

•

Securities Statements Filed by Manufacturers with SEC

A registration statement has been filed with the Securities and Exchange Commission, covering voting trust certificates for 175,230 shares common stock of the Emerson Electric Manufacturing Company.

York Ice Machinery Corporation has filed registration statement, covering $1,500,000 first mortgage convertible bonds, due 1947, and $1,500,000 convertible notes due 1947. Coupon rate on both the bonds and notes will be filed by amendment. Company also registered 66,714 shares of 5 per cent

convertible first preferred $100 par, and 80,057 shares of common stock, no par, to be issued in exchange for 53,371 shares of 7 per cent preferred. The statement covered an undetermined number of common shares to be reserved for conversion of the bonds, notes and 5 per cent first preferred stock.

•

Manufacturers Make Sales Assignments

Electrical manufacturing companies have recently made the following appointments to their sales staffs:

Appointment of Don M. Chriss to the department store sales staff has recently been announced by R. E. Imhoff, Westinghouse merchandising division sales manager.

Link-Belt Company—Harold L. Hoefman, manager of plant, warehouse and sales office at Atlanta, Ga., to succeed the late I. H. Barbee. George A. Paige appointed to succeed Mr. Hoefman in Detroit and Laurance O. Millard takes Mr. Paige's place at Pittsburgh. Paul V. Wheeler has succeeded Mr. Millard in Cleveland.

Simplex Wire & Cable Company announced the opening of a branch office in Atlanta, Ga., under the management of A. Kenneth Felix.

The Jacksonville branch of the Graybar Electric Company started to operate as a main house beginning January 1, with Savannah, Miami, Orlando, and Tampa as branch offices. Douglas Wallace has been appointed district manager with headquarters at Jacksonville. C. G. Matthews, manager at Milwaukee, has been appointed sales manager at Boston, replacing F. X. Fitzpatrick, who, on account of ill health, has asked to be relieved. R. J. Harkins has been appointed manager at Milwaukee.

•

Electrical Equipment Sales by Manufacturers Drop 19%

Manufacturers' sales of electrical machinery, apparatus and supplies in November amounted to $19,748,000, compared with $24,388,000 in October and $17,901,000 in November, 1936, according to the Department of Commerce.

Wholesalers' sales of electrical goods in November totaled $14,808,000 as against $15,635,000 in October and $14,153,000 in November, 1936.

New York Metal Prices

	Jan. 4, 1937 Cents per Pound	Jan. 11, 1938 Cents per Pound
Copper electrolytic	10.125*	10.875*
Lead Am. S. & R. price	4.75	4.90
Antimony	13.75	13.75
Nickel ingot	35.00	35.00
Zinc spot	5.35	5.35
Tin Straits	41.625	42.875
Aluminum, 99 per cent	20.00	20.00

* Delivered Connecticut Valley.

Reliable OFFERS ANOTHER NEW DEVELOPMENT IN LINE SPLICING . . . .

★ The completely non-ferrous splice.
★ The splices and deadends with tapered wire fitting ends.
★ The splices and deadends with mechanism to make jaws float in proper position.
★ Splices and deadends for type "A" Copperweld.

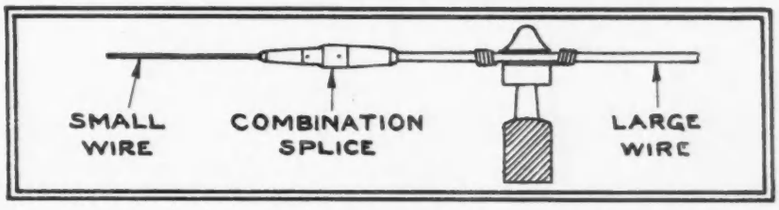
And Now . . .

THE COMBINATION STRAIGHTLINE SPLICE

Save money by using RELIABLE COMBINATION STRAIGHTLINE SPLICES in urban distribution where a line drops a portion of the load and the next smaller size of wire will carry the current flowing through the rest of the circuit.

•

Less Costly Construction . . .
A Neater Job...A Strong Joint



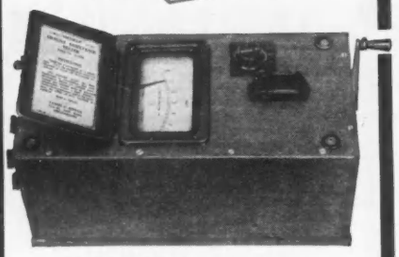
The change of wire size without a double dead end only makes it necessary to increase the sag of the larger wire two or three inches, as the spans of city distribution are short.

Distributed By

GRAYBAR ELECTRIC CO.
JOSLYN MFG. & SUPPLY CO., and Subsidiaries

Reliable ELECTRIC COMPANY
OVER 25 YEARS SERVICE TO THE UTILITIES
3145 CARROLL AVENUE • CHICAGO ILLINOIS

"MEGGER"
GROUND TESTER



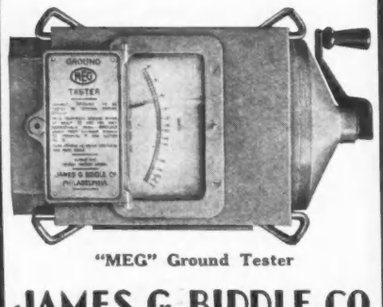
"MEGGER" Ground Tester

Your Protection

Tests and field experience indicate that measurements of ground resistance are essential for adequate protection against lightning, for proper system relay operation, and for human safety.

"Megger" and "Meg" Ground Testers have contributed to grounding and ground testing, the same features of accuracy, simplicity, ruggedness and reliability, that are so characteristic of "Megger" and "Meg" instruments for testing insulation resistance. Need more be said?

Catalog 1425-W contains a full description of these instruments, including principle of operation and suggestions for their application. Your copy will be sent on request.



"MEG" Ground Tester

JAMES G. BIDDLE CO.

ELECTRICAL INSTRUMENTS

1211-13 ARCH STREET PHILADELPHIA, PA.

Other Biddle Specialties:

"Megger" Insulation Testing Instruments
"Megger" Capacitance Meter
"Megger" Direct-Reading Ohmmeters
"Ducter" Low Resistance Testing Sets
"Dionic" Water Tester
"Frahm" Vibrating-Reed Tachometers and Frequency Meters
"Jagabi" Rheostats
"Jagabi" Speed-Measuring Instruments

Field Reports on Business

Trade continues spotty, with very little change in most lines from the preceding week. Some buying to fill inventory voids has been noted. The stiffening of some prices has lent encouragement for a pick-up in general business in the spring.

NEW YORK

The steady rise in security prices of late has given encouragement that business will be better in the spring. During the past two weeks one large smelter has increased copper prices ⅝ cent. The government's shipbuilding program, together with the armament plans of other nations, is expected to aid the heavy industries. Since most of the money spent in this direction goes to labor, purchasing power is due for a lift.

Manufacturers are working mostly on backlogs, which have been somewhat depleted in recent months. Forward buying has been slow, with the first quarter likely to be under the fourth of 1937.

Retail outlets indicate that appliance sales have shown a drop, but they expect better times as sales campaigns stimulate renewed buying. The electric utilities are giving every assistance to dealers in moving stocks.

The continued blasts against so-called big business by government officials have left many industrial leaders resentful that industry should be made the target to divert public attention from more important Administration doings. They claim that so much caution is being used in operations that it is hurting business. It is felt that a greater degree of co-operation and encouragement is a better answer than the use of a stick.

NEW ENGLAND

A slight increase in inquiries for industrial equipment during the past week as compared with the latter part of December is reported from a number of prominent offices in this district. Heavy equipment remains, as for some time past, a dull spot in the local market picture; one manufacturer notes a few single orders for motors, all under 10 hp.; interest in central station supplies is slack; wiring contracts for store renovations running into amounts averaging about $1,000 and involving new lighting effects for interior and window display are quite numerous in the Boston retail district. New construction supplies involving electric refrigeration, elevator and air conditioning for a new Cambridge apartment which will be built in the spring will be required later. A contract for construction of a large flood emergency sewage system which includes in its equipment two 75-hp. Diesel power pumping units for the city of Springfield, Mass., the total cost of which will be about $200,000, will be commenced within a short time.

Interest in floodlighting ski runs in the northern areas in this district is increasing; recently the Worcester County ski run was provided with floodlights. Merchandise sales were quiet, with dealers reduced to little or no stock on hand.

While the three major industrial activities, shoe, textile and machine manufacturing enterprises, are passing through the usual reduced scale of operations expected at this time, and accentuated this year during the past two months, the outlook is by no means a pessimistic one. In the opinion of a number of officials, some quickening in buying electrical machinery and supplies may be expected within a reasonably short time.

PACIFIC COAST

The consensus is that coast business retardation will cease by March and that such local factors as railroad and utility construction and increased private building due to FHA legislation will make the 1938 volume equal that of 1937. The main railroad source will be the Bay Bridge interurban system with its dual catenary and third rail lines, station machinery and individual car equipment. The catenary and feeders will be awarded in February. Other items include the wiring job for the $7,000,000 Los Angeles Union depot and several storage warehouses, especially for Seattle and Spokane. Much new signaling equipment is contingent upon the petitioned 15 per cent freight rate increase. Utility buying is heavy all over the territory, but especially in southern California, where awards are pending for $15,000 creosoted crossarms, seven carloads No. 3 braid weatherproof wire Nos. 8 and 2 sizes, two carloads No. 3/0 bare copper wire, 48 subway transformers and a year's contract for distribution and small power transformers.

Predicted Boulder plant revenue for 1938 is $1,000,000 for machinery payment and $2,500,000 for power. Central California utility business features stock size transformers and two 900-kva. regulators totaling $125,000 for the Fresno area and 333- and 500-kva. shipments to the Sacramento and Reno districts.

Wholesalers are facing the new year with disproportionate stocks and, barring orders to replace a few short items, stock purchasing will probably be light until spring. Exceptionally vigorous following has resulted in a satisfactory collection rate that now is prevailing.

CHICAGO

Orders for electrical equipment are currently averaging approximately 25 per cent less than at this time a year ago. Sales of appliances are better than the general average, but the heavy industrial machinery is lagging far behind. However, replenishment of inventories on a normal scale, as surpluses are worked off, is expected to result in early improvement over the present volume.

Installations of electric ranges show marked increases over last year, but have not, as yet, reached a sizable figure. Small motors are in demand, one manufacturer reporting an order for 456 with a total capacity of less than 900 hp. Several large office remodeling jobs have materially benefited lighting equipment sales. Contractors report a fair amount of additional outlet work, but that the total volume is about 20 per cent under last year at this time. The telephone company reports its inability to supply the demand for the new type hand sets now being installed.

General business activity in this area continues to be spotty. Retail trade is being stimulated by special sales and wholesalers show some improvement since the first of the year. Slight encouragement may be had from the gain in steel production in this district. Industrial activity, on the whole, is still lagging and building construction shows small tendency toward improvement.

CHAMPION ICE-MAKER: 1938 KELVINATOR!

READ—AND WE BELIEVE YOU'LL AGREE: THIS IS A DEVELOPMENT THAT RATES WITH THE GREATEST SINCE ELECTRICAL REFRIGERATION WAS BORN

SET YOURSELF for the big news about Kelvinator for 1938!

It's the biggest thing we've ever put before the industry. The greatest product . . . the most powerful advertising program. . .

An absolutely brand-new, revolutionary idea in LOCAL, ON-THE-SPOT advertising for *each* dealer . . . plus SALES SUPPORT and active SELLING HELP never before equalled!

Literally, the greatest co-operation between manufacturer and dealer since the electric refrigerator business was born!

Look at the Product!

When we call the new 1938 Kelvinator the Champion Ice-Maker, we mean every word of it!

Its new, sealed, super-silent Polar Power Unit is so efficient and economical, it delivers 72 *big ice cubes for 1¢* (figured at the national average rate for electric current).

But that's only one among many new features Kelvinator has to offer in 1938. There's more—lots more—in the list over on the opposite page. Read it. And still more not even mentioned there that you'll have to see to appreciate.

Look at the Advertising!

In short, we've got a refrigerator here so grand that no advertising technique ever used before was good enough to show it.

So we had to invent a new one—a brand new way of glorifying a refrigerator in pictures . . . telling a whole sales story in pictures . . . that will be one of the biggest wallops of the year!

And how we're going to use it! Full pages . . . full color . . . a full schedule running *continuously* in the most influential magazines in the country. Full pages in color in the Sunday sections of city newspapers—plus a big campaign in dailies—all listing dealer names!

Smashing, fighting, power-house stuff—built to make sales.

Look at the Sales Support!

Every bit of this pointed right straight to YOUR door—where you'll be prepared to meet it with the greatest sales-closing force ever put into the hands of any refrigerator dealer.

Because we've got a plan for you that will do the business!

It includes INDIVIDUALLY TAILORED local advertising . . . over your OWN name . . . in the newspapers which YOU PICK YOURSELF.

Even more important . . . It includes a SALES-CLOSING program that's the hottest thing going, today. You never saw so many tested and approved sales-training materials . . . door openers . . . carefully planned seasonal selling campaigns! Or more generous customer financing plans.

And there's plenty more! Absolutely everything you need to go to town in 1938—in a big way!

Act Now!

See the new Kelvinators and get the full 1938 story from your nearest Kelvinator distributor. Or write, Dept. E-1,

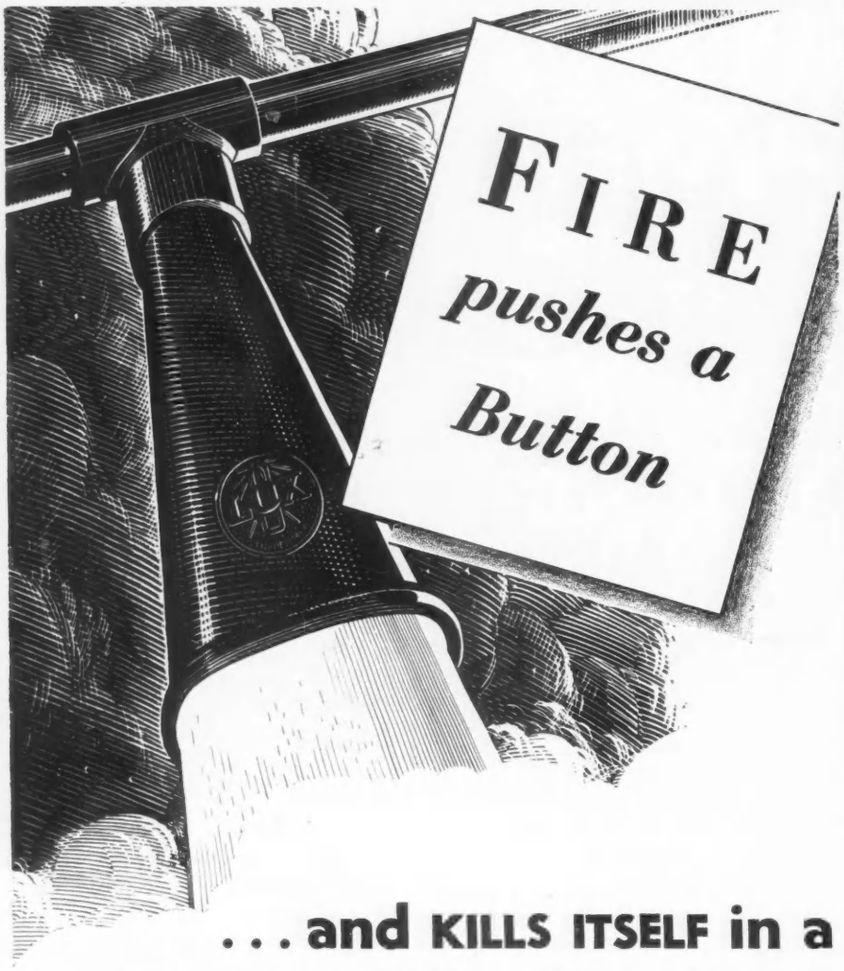
KELVINATOR, DIVISION OF
NASH-KELVINATOR CORPORATION
Plymouth Road . . Detroit, Michigan

$8,000.00 CONTEST OPEN TO INDUSTRY UNTIL JANUARY 30TH!

ANYBODY CAN GET IN . . . open to everybody in the industry! Except factory or office employees of Nash-Kelvinator. President or office boy . . . distributor or dealer . . . retail or wholesale salesmen . . . friend or foe! *FIRST PRIZE, $5,000!* Seven other prizes! Worth trying for! Easy—Just write fifty frank words.

See your nearest Kelvinator distributor. He'll give you all details; show you the line, the features . . . tell you the whole sales and advertising story. Come one, come all! Get into this now!

The Champion Ice-Maker



. . . and KILLS ITSELF in a Blizzard of Spotless Snow

● Are you ready for fire? Here is the surest safeguard you can give to generation and distribution equipment.

It is automatic — self-acting. Fire actuates a tiny thermostat, pushes a button. Then the LUX system springs into action, floods the equipment with a fast-expanding cloud of Lux carbon-dioxide snow-and-gas. Lux kills fires in a few seconds.

Shielded Nozzles

Pictured above is the Lux Shielded Nozzle, a number of which are placed at vantage points in the places protected. The nozzle delivers Lux gas and snow without turbulence, giving faster extinguishing action.

Lux carbon-dioxide snow is not only *completely* harmless to electrical equipment, but it is also the *fastest* known extinguishing agent. It is your surest protection against electrical fires.

Send for your copy of "LUX Makes the Difference," a valuable addition to your files.

Walter Kidde & Company

10 West Street, Bloomfield, N. J.

Sales Opportunities

WILKESBORO, N. C.—Duke Power Company, Charlotte, N. C., plans extensions in transmission lines in parts of Wilkes County, including new line from Wilkesboro on Highway 121 to point near Ronda Road, about 15 miles, where terminal will be established for several branch transmission lines in that area; also will make extensions in transmission line in vicinity of Call, to Windy Gap, Lovelace and vicinity, where distribution facilities will be installed. Another extension in same district will include a new transmission line from Boomer to Wilkes-Caldwell county line for service in that area. Power substations will be built at different points for local distribution.

QUINALT, WASH.—Quinalt Light Company, Quinalt, has plans maturing for new hydroelectric generating station on site in national forest area. Bids will be asked soon for water-wheel, electric generator and auxiliary equipment. A transmission line will be built. Financing has been arranged through Federal aid.

LOS ANGELES, CALIF. — Metropolitan Water District, 306 West Third Street, receives bids until January 18 for five controlled frequency generator sets for installation in pumping stations on Colorado River Aqueduct (Specifications 267).

DENVER, COLO.—Oriental Refining Company, Equitable Building, Max P. Zall, head, plans installation of motors and controls, conveyors, electric pumping machinery and other equipment in connection with expansion and improvements in oil refining plant at East Fifty-second Avenue and Colorado Boulevard. Work is scheduled to begin soon. Cost about $150,000.

FLANDREAU, S. D.—Has called a special election on January 18, to approve bond issue of $158,000 for acquisition of local generating station and distributing system of Union Public Service Company, and for expansion and improvements in power plant, including installation of two new diesel engine-generator units and auxiliary equipment.

TOMAHAWK, WIS.—Wisconsin Public Service Corporation, Milwaukee, is having plans prepared by Utility Engineering & Service Corporation, 231 South LaSalle Street, Chicago, Ill., consulting engineer, for proposed new hydroelectric generating station on Wisconsin River vicinity of Grandfather Falls, near Tomahawk, previously referred to in these columns. Work is scheduled to begin early in spring. Project will include new transmission line to Wausau, Wis., and vicinity, and is estimated to cost $1,675,000. Equipment orders will be placed soon.

DALLAS, TEX.—Coca-Cola Company, Atlanta, Ga., plans installation of motors and controls, conveyors, regulators, electric hoists, loaders and other equipment in new branch plant at Lemmon Street and Mockingbird Lane, Dallas, where large tract of land has been acquired. Plant will comprise several one and multi-story units, with power house, power substation and other mechanical operating divisions. Proposed to begin work soon. Cost close to $850,000. Robert & Company, Bona Allen Building, Atlanta, are architects and engineers.

HILLSDALE, MICH.—Has plans nearing completion for extensions and improvements in municipal electric power plant, including installation of new generator unit and auxiliary equipment. Cost about $110,-

OF INTEREST TO TELEPHONE USERS

I think many people have only a vague idea of how our company functions within the Bell System, and how a unique business philosophy is operating to make your telephone service increasingly dependable and economical. This advertisement is the briefest possible statement of the philosophy that guides the Western Electric Company.

PRESIDENT

In 1882 the Bell System became convinced that the best way to assure uniformity of equipment necessary for universal telephone service was to control its manufacture through *one* organization. To this end it acquired the Western Electric Company, which operates under this three-fold policy:

1. *To make telephone apparatus of high quality.*

This in itself is not unusual. What *is* unusual is that every item of equipment in the vast network of the Bell System must coordinate so perfectly that from any Bell telephone you can talk clearly with any one of the millions of others. Can you think of any other product which must meet such an extraordinary test?

2. *To work for efficiency and lower costs.*

Whether it be in purchasing materials—or in manufacturing the 43,000 items of telephone apparatus—or in distributing all this equipment to the Bell companies, Western Electric is always seeking the better way. As a result it has a progressive record of methods developed, products improved, economies effected, and costs lowered.

3. *To keep prices at the lowest possible level consistent with financial safety.*

Western Electric furnishes most of the telephone equipment used by the operating companies of the System. By combining their requirements it is able to manufacture more economically; and it eliminates selling expenses and credit losses. The resulting savings it passes along to its telephone customers in the form of lower prices.

On these sales the policy of the Company is to set the lowest prices which will enable it to pay fair wages to its employees, to earn a fair return on the money invested in the business, and to maintain the Company's financial stability.

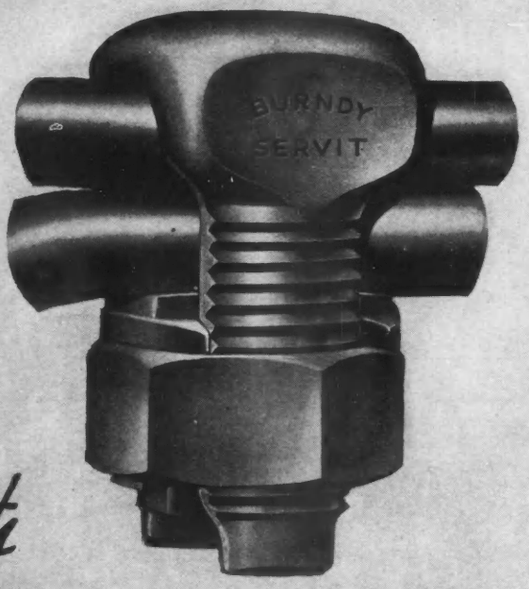
This policy of voluntarily limiting profits is reflected in the Company's financial record. In recent years it has earned on its investment a rate of return only about half as large as that of a representative group of comparable manufacturers, and over a period of twenty years this rate has averaged less than 7%.

This set-up within the Bell System results in low costs to your Telephone Company, and thus Western Electric contributes its part in making Bell Telephone service dependable and economical.

Western Electric

BELL SYSTEM SERVICE IS BASED ON WESTERN ELECTRIC QUALITY

first choice...



with

ENGINEERS, PURCHASING AGENTS AND LINEMEN *Everywhere!*

because it takes but a moment to apply; just insert the conductors, spin the nut and tighten with a wrench

because it withstands overload, vibration, corrosion and high wrench torque

because it's made in a complete range of sizes from No. 10 solid wire to 1,000 Mcm stranded cable

because it's economical...low in cost and re-usable

specify the

BURNDY SERVIT

"the service connector that's forged of Durium"

BURNDY ENGINEERING CO., INC.

459 E. 133d ST., NEW YORK, N. Y.

000. Hamilton & Weber, Grand Rapids, Mich., are consulting engineers. Proposed to begin work soon.

MARTINEZ, CALIF.—Pacific Gas & Electric Company, San Francisco, has authorized an appropriation of $5,000,000 for construction of a new steam-electric generating plant in the vicinity of Martinez, Contra Costa County, including extensions in transmission lines in that area. Orders for turbo-generators, high-pressure boilers and auxiliary equipment are scheduled to be placed soon. This is part of 1938 expansion and improvement program of company which will also include another fund of $5,000,000 for new power substation, switching stations, transmission and distributing lines in different parts of county noted.

ORD, NEB.—North Loup Public Power & Irrigation District, Ord, E. H. Dunmire, engineer and manager, plans new transmission line from Olean to Burwell, Neb., about 40 miles. Application has been made for permission. Black & Veatch, 4706 Broadway, Kansas, City, Mo., are consulting engineers.

INDIANAPOLIS, IND.—Allison Engineering Company, Speedway City, Indianapolis, plans installations of motors and controls, regulators, conveyors and other equipment in new one-story addition to airplane engine-manufacturing plant, 190x250 feet. Cost close to $100,000. Superstructure will begin in January. J. Loyd Allen, Architects' and Builders' Building, Indianapolis, is architect. Company is a subsidiary of General Motors Corporation, Detroit, Mich.

WAHJAMEGA, MICH.—State Department of Public Buildings, Lansing, Mich., has plans under way for rebuilding of power plant at Michigan Farm Colony, Wahjamega, including installation of generating units and accessories, boilers and other equipment. Cost close to $360,000. E. R. Little, Ford Building, Detroit, Mich. is consulting engineer.

WASHINGTON, D. C.—Bureau of Yards and Docks, Navy Department, Washington, receives bids (no closing date stated) for motor-driven pumping machinery and auxiliaries, and air-conditioning equipment for dry dock at navy yard, Mare Island, Calif. (Specifications 8516).

ENDICOTT, N. Y.—Plans extensions and improvements in municipal electric power plant, including installation of additional equipment. Also, will make extensions and improvements in transmission and distributing lines, including replacements. Proposed to carry out work early in spring. H. W. Lauder is superintendent at municipal power station.

BURBANK, CALIF.—Lockheed Aircraft Corporation, Victory Place and Empire Avenue, plans installation of motors and controls, conveyors, electric hoists and other equipment in new addition to airplane manufacturing plant, 36 x 160 feet, for which superstructure will begin soon. Cost close to $100,000 with machinery. John and Donald B. Parkinson, Title Insurance Building, Los Angeles, are architects.

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Building to House New Unit

A WPA project started in Clayton, N. M., recently will provide additional room at the city light and power plant to house a new power unit which will have to be installed in the near future to take care of the increasing demand for power.

Look for the ILLINOIS TRADE MARK

on the Porcelain used by manufacturers of Electrical Equipment.

It is your guarantee of

. . . SUPERLATIVE QUALITY

. . . EXACT DIMENSIONS AND

. . . UNFAILING LONG LIFE

INSIST ON ILLINOIS PORCELAIN FOR DEPENDABLE SERVICE AND LOW COST.

ILLINOIS ELECTRIC PORCELAIN CO.
MACOMB, ILL.

HIGHEST QUALITY INSULATION FOR ALL TYPES OF ELECTRICAL EQUIPMENT

ILLINOIS HIGH VOLTAGE SUSPENSION INSULATORS MEET ALL CONDITIONS OF LINE CONSTRUCTION

ILLINOIS TRANSMISSION LINE INSULATORS . . .

LARGE STOCKS CARRIED AT ALL TIMES.

ILLINOIS DISTRIBUTION INSULATORS

Designed to meet every distribution line requirement

A rugged design, consistent in shape, neat, strong, and compact with high electrical values. Each size takes a wide range of conductor sizes. Made from the same high grade porcelain as is used in the manufacture of the larger high voltage insulators.

Beautiful illustrated new catalog just off the press . . . Write for your copy today

ACCURACY IN DIMENSIONS

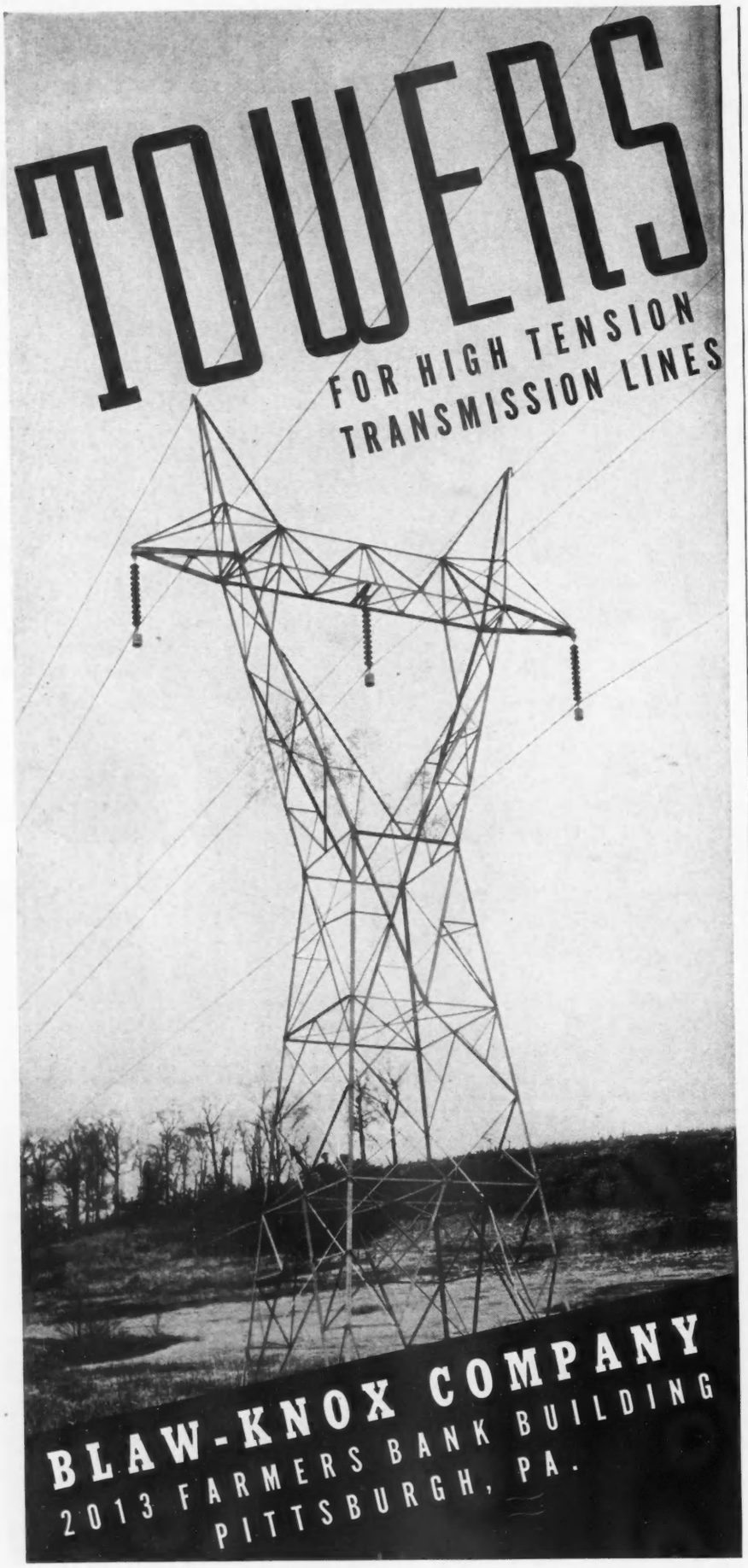
★

HIGHEST QUALITY PRODUCTS

to Standardize on

ILLINOIS

is a Progressive Step



Municipal Plants

IOWA CITY, IOWA—District Judge Harold D. Evans has dismissed the $11,534 suit brought by Burns & McDonnell Engineering Company of Kansas City, Mo., against the city. The engineering company had been engaged by a previous city council to do preliminary work for a proposed municipal electric light plant. When the new city council, which was opposed to a municipal plant, was elected last spring, the plans for the erection of the plant were dropped. Burns & McDonnell claimed the money was still due for work done. In his decision the judge sustained the defense motion for a directed verdict because of the Simmer law that provides that municipal light plants be paid for out of electrical earnings and not from general taxes. To pay the sum requested the money would have to come from the taxpayers.

MILFORD, IOWA—State Supreme Court has ruled that the contract between the town and the Monroe Electric Company for the construction of the municipal electric plant is valid. A suit had been brought against the town and the Monroe Electric Company by a group of persons representing some Milford taxpayers in the district court at Spencer and Judge G. A. Heald had held the contract invalid due to lack of competitive bidding. The Supreme court found the contract let legally and ordered Judge Heald to issue a new ruling accordingly. The plant is in operation. In another ruling the supreme court held valid a contract between the town of Milford and the Northwestern Light & Power Company for street lighting. This had also been appealed from the decision of the district judge.

NORWALK, OHIO—Former Mayor Cort M. Schock has filed an injunction suit against the city, naming as defendants the mayor, safety-service director, members of the city board of control and Max G. Irvin, superintendent of the municipal light plant, attacking the ordinance under which energy from the municipal plant is being supplied to consumers of the near-by village of Milan, O. Mr. Schock averred the contract entered into between Norwalk and Milan is illegal, because a referendum action started in Milan is still pending in the Ohio Supreme Court. He also states the city is violating a state statute by selling more than 50 per cent of the power generated to patrons outside the city.

SOUTH NORFOLK, VA.—Town is proceeding with plans for a municipally-owned light and power plant to cost an estimated $33,000. Wiley & Wilson of Lynchburg, Va., are the engineers.

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Employee Appliance Survey

A recent survey of appliance ownership among employees of Potomac Edison Company showed that radios, with a saturation of 93 per cent, lead among major appliances. Refrigerator saturation was 79 per cent; washer, 71; I.E.S. lamp, 55; range, 43; ironer, 13, and water heater, 8. Irons, with a saturation of 79 per cent, lead among minor appliances and toasters, 68 per cent, waffle irons and percolators, each 45 per cent, followed.

TAYLOR

VULCANIZED FIBRE • PHENOL FIBRE
TAYLOR INSULATION • SILENT GEARS

To assure uniform insulating quality of Taylor Vulcanized Fibre, Taylor Insulation and Taylor Phenol Fibre, the original paper stock in Taylor's own Paper Mill passes through many steps of carefully controlled processing to eliminate any metal or other impurities which might affect insulating value of the finished product.

The final safeguard, shown below, is one of a battery of four huge, high-speed, centrifugal extractors which take the liquid paper stock and whirl out any possible remaining foreign materials. Only a few of the highest-grade paper manufacturers employ similar equipment for positive assurance of a perfectly clean sheet.

Coming from this most modern, most scientifically equipped mill of its kind in the world — Taylor Vulcanized Fibre, Taylor Insulation and Taylor Phenol Fibre *have to be good.*

You can depend upon it.

TAYLOR FIBRE COMPANY
NORRISTOWN, PA.

Mr. Utility Executive

Did You Know That

Last year another Utility* increased their Gross Annual Revenue $75,000.00 with a UNIVERSAL COOLER Refrigerator activity?

If you are looking for a proved plan that will enable you to turn unprofitable small users into profitable customers, without disturbing existing dealer relationships, Universal Cooler's unique program will interest you. Write for complete information.

*Name on request.

UNIVERSAL COOLER CORPORATION
DETROIT, MICHIGAN
In Canada: Universal Cooler Co. of Canada, Ltd., Brantford, Ont.

BIAS TAPES *with plenty of* **STRETCH!**

ACME bias tapes fit snugly around corners, into slots and over uneven surfaces because they have exceptional flexibility (stretch), and the tensile strength to stand the pull. These qualities are due to an Acme-developed process of applying pure vegetable oil varnishes of Acme formula to highest grade cotton fabric. Available in bias or straight tapes and rolls up to 36" wide—yellow or black. Samples if desired.

Acme Wire PRODUCTS

The Acme Wire Co., New Haven, Conn.
MAGNET WIRE—COILS—VARNISHED INSULATIONS—CAPACITORS

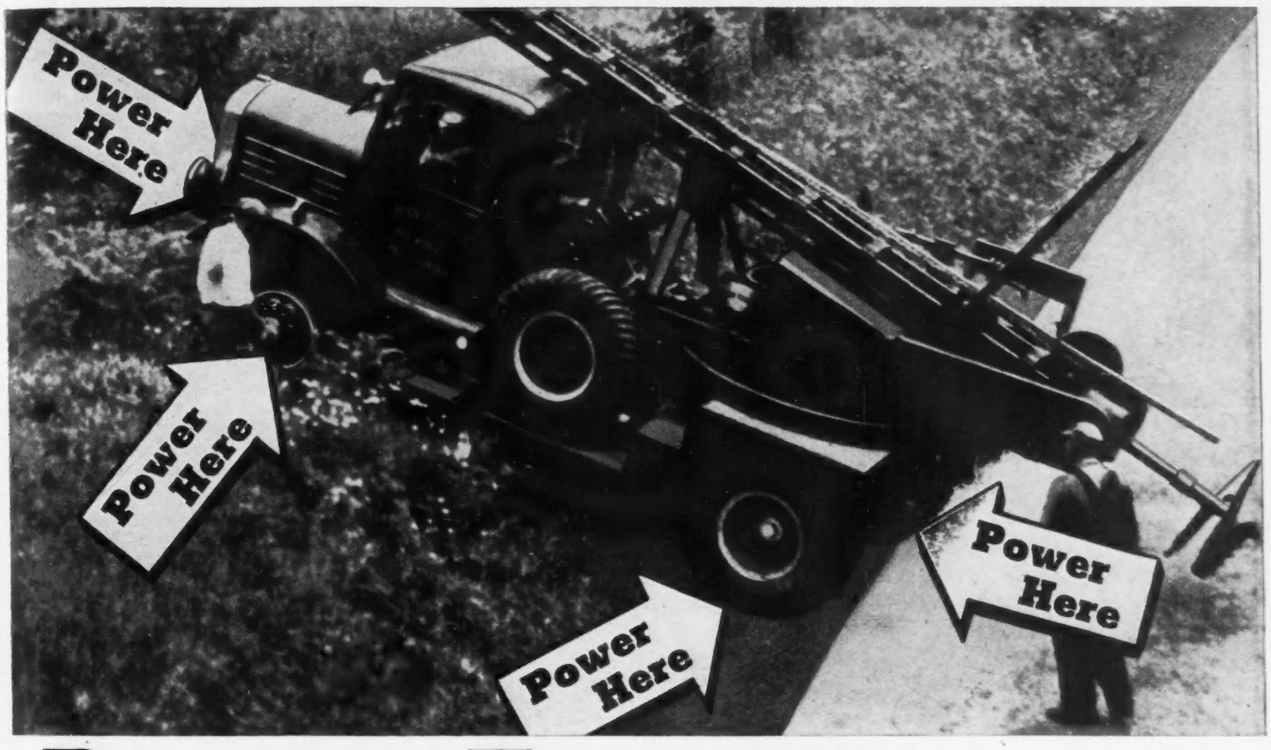
Recent Rate Changes

UTAH POWER & LIGHT COMPANY has been ordered by the state Public Service Commission to reduce its electric rates to its Utah customers $350,000 a year. The order brings to conclusion the rate case brought against the company four years ago, which resulted in an extensive inquiry into rates and practices of Utah's largest electric utility. The savings to be made possible by the order, affecting all classes of users, will bring total reductions ordered by the commission since the case was instituted in 1933, to approximately $850,000. Chairman Ward C. Holbrook of the commission stated the order provides that more than half the saving will accrue to residential and farm consumers, with the next largest reduction going to small power users and the remainder being divided between commercial light and large power consumers. There will be a simple, uniform residential schedule, with rates ranging from 1.5 cents to 5 cents a kilowatt-hour after the minimum charge of 90 cents for the first 11 kw.-hr. It will be put into effect on April 1. This schedule will be applicable to all domestic consumers regardless of locality of residence and domestic use to which the electricity is put. Under the old schedules residential consumers in Salt Lake City, Ogden and Provo have paid a somewhat lower rate than those in other parts of the state. Other major changes are: (1) Deferred payment charge on residential and commercial bills will be reduced from 10 to 5 per cent, effective July 1, 1938; (2) commercial lighting rates will be reduced on the same date so that the price of service will range from 2.5 cents to 5 cents per kilowatt-hour after the minimum charge; (3) a 15 per cent cut in rates charged small power users went into effect January 1, with an additional 5 per cent reduction on July 1. The commission fixed a valuation on the property of the company, used and useful in giving service to Utah consumers, of $73,045,647. The company had submitted a figure of $78,052,415, based on reproduction cost new less depreciation. In establishing the valuation the commission rejected the reproduction-cost-new theory as the sole method of arriving at a valuation for rate-making purposes.

PEOPLES LIGHT COMPANY has voluntarily reduced electric rates, household and commercial, in Davenport $90,000 a year, effective January 1. In 1935 when a reduction in both domestic rates and commercial rates was made, the company promised the members of the city council that a further reduction would be forthcoming whenever it felt it could do so. "We are now keeping the promise which we made at that time," Harry E. Littig, general manager, stated. The present household rate provides for a charge of 6 cents per kilowatt-hour for the first 10 kw.-hr.; the next 15 at 5 cents per kilowatt-hour; the next 175 at 2.7 per kilowatt-hour and all over 200 at 2 cents per kilowatt-hour. The new rate will be as follows: for the first 25 kw.-hr., 5 cents per kilowatt-hour; for the next 25, three cents per kilowatt-hour; for the nevt 150 kw.-hr. 2½ cents and for all in excess of 200 kw.-hr. 2 cents per kilowatt-hour. The minimum monthly charge will be 60 cents as in the past. Proportionate reductions will be made in the commercial rate.

CITIZENS ELECTRIC COMPANY of Hot Springs, Ark., has been authorized by the state Public Service Commission to reduce its electric rates $84,725 annually. Residential customers will save $25,097 annually. Savings to the commercial customers will total $44,036. The balance of the reduction will go to small power users. In-

THE ORIGINAL FOUR-WHEEL-DRIVE TRUCK



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Insures Outstanding Performance

POWER — scientifically distributed over four wheels — instead of only two. That's the engineering principle — the positive traction — that has singled out FWD for outstanding performance — enduring service — unusual economy.

Stress on each driving axle is reduced by half. 100,000 miles and more per set of tires is not unusual. Only 11.8% of the developed power is lost in friction — an amazing performance indeed!

The FWD is a safer truck. It is more economical to operate. It will serve you longer. Not because we say so. But because of exclusive FWD engineering superiorities *which are susceptible of proof.* In the world's toughest trucking — in cross-country oil field and utility construction — in almost impassable timber lands—thru Northern Snow Drifts that would baffle anything but *Four-Wheel-Drive* construction — *Positive Traction* has given FWD an enviable reputation for outstanding performance.

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DIXIE

JACKSON LUMBER COMPANY
LOCKHART, ALABAMA

A CROSSETT WATZEK GATES INDUSTRY

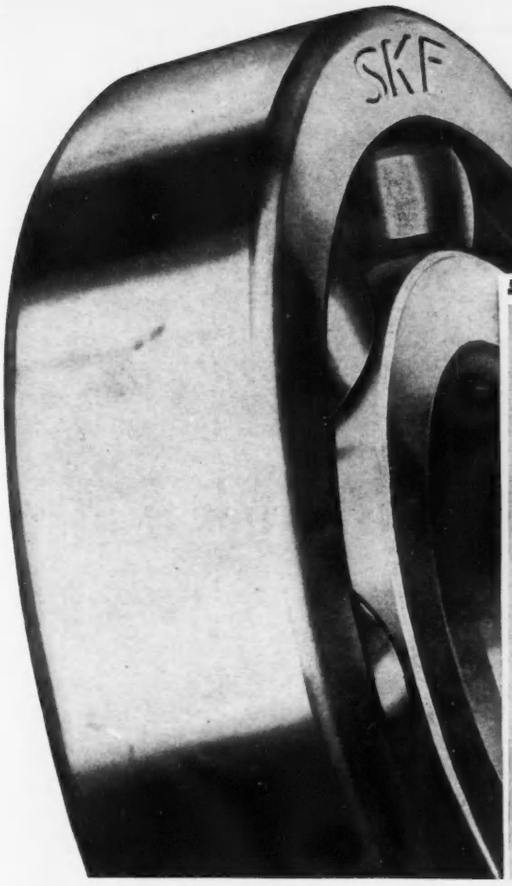
cluded in the total reduction is a recently authorized cut of approximately $5,000 in street light service charges. The new schedule for residential consumers is 7 cents per kilowatt-hour for the first 25 kw.-hr.; 5 cents per kilowatt-hour for the next 25 kw.-hr.; 3½ cents per kilowatt-hour for the next 75 kw.-hr.; 2½ cents per kilowatt-hour for additional energy. The schedule for commercial customers: 7 cents per kilowatt-hour for the first 100 kw.-hr.; 5 cents per kilowatt-hour for the next 150 kw.-hr.; 4 cents per kilowatt-hour for the next 350 kw.-hr.; 3 cents per kilowatt-hour for the next 700 kw.-hr.; 2½ cents per kilowatt-hour for all additional power. Residential savings on typical bills will range from 50 cents to $3.40 per month for residential consumers and from 50 cents to $42.50 per month for commercial consumers, the commission stated.

CENTRAL STATES POWER & LIGHT CORPORATION has reduced residential and commercial lighting rates in Benton, Bardwell, Arlington and Milburn $6,000 annually. The reduction represents a cut of approximately 18 per cent, effective with February billings.

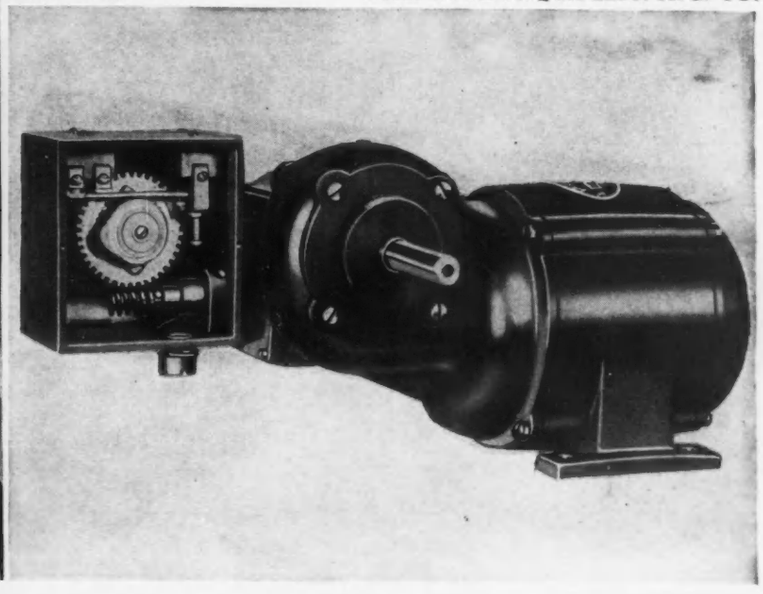
CENTRAL NEW YORK POWER CORPORATION has filed revised rate schedules with the state Public Service Commission which reduces rates for general commercial and small power purposes and for large industrial purposes in the Rome district of the company's territory and postpones cancellation of a large use industrial rate in the Utica district of the company's territory. In the Rome district, commercial customers will secure a net saving of $12,602 annually. There will be a net increase to industrial power consumers of $28,661 annually, making a net increase for the district of $16,059.

JACKSONVILLE, FLA., commissioners have approved a recommendation by Utilities Commissioner Ernest E. Andrews that a reduction be made in the rate for domestic consumers at a saving of approximately $90,000 to about 30,000 electric customers living within the city limits. Under the proposal the top of the domestic schedule has been reduced from 7 to 6 cents for the first 35 kw.-hr.; next 40 kw.-hr. at 5 cents; 2 cents for the next 225 kw.-hr. and 1½ cents for all over 300 kw.-hr. At the same time the commission, also on Mr. Anders' suggestion, asked City Council to carry over a surplus of $60,000 to $70,000 in 1937's earnings to this year's revenues to help make up for the losses in revenue, which will result from the rate reduction. The new rate cut becomes effective with the meter readings in April.

NEW YORK Public Service Commission has announced the filing of the following new schedules: (1) village of Angelica, a revision of rates which reduces rural minimum charges and makes other minor changes in the schedules of the municipal plant. Changes make reductions of $53 annually to 20 rural consumers. The minimum charge is reduced to customers on existing lines outside the village from $2 to $1.50. (2) City of Jamestown, new schedules making reductions to all classes of customers to the amount of $113,683 annually. Of the total saving, $98,230 will be saved by consumers within the City of Jamestown and $15,453 by users outside of the city. The new rates will mean savings of $43,292 a year to residential consumers within the city and $54,938 a year to general commercial users within the city while the residential consumers outside the city will save $7,434 annually and general commercial customers outside the city will save $8,019 a year. (3) Commission has approved electric rate reduction of the municipal plant of Hamilton, amounting to $3,500 a year.



SKF-EQUIPPED BUILT BY THE PIQUA ELEC. MFG. CO.



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SKF *Ball Bearings assure precision*

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You can depend upon SKF Bearings to give top performance not only on geared motors but on all types of electrical equipment. For the precision which characterizes the manufacture of every SKF Bearing is maintained throughout its entire life. Where the utmost is expected of electrical equipment, SKF's do their part at the least cost per bearing dollar.

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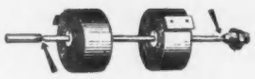

Bimetallic coils and center shaft of actuating element

In the above illustration the arrows indicate the only points of possible wear in the actuating element. Even here the motion is little. There is no appreciable wear in years of service.

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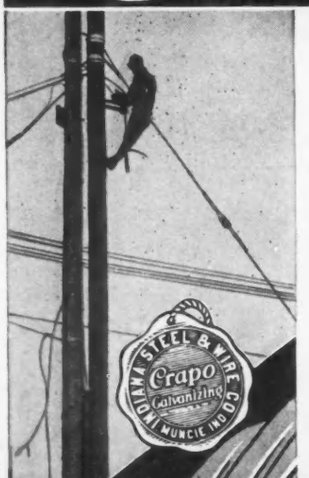


SPECIFIED BECAUSE OF PROVED PERFORMANCE

Crapo Galvanized Steel Strand has earned its enviable reputation for long, dependable, economical life by outstanding performances in actual service. That's why it so often is specified by leading utilities for the more important construction jobs. The heavy, uniform, pure zinc coating—applied by the *Crapo* Process—is notable for its adhesion and ductility; its ability to withstand bending and twisting; its lasting resistance to corrosion. Both the finished strand, and the wire from which it is made, conform in every detail to the most rigid specifications for tensile strength, elongation, size, galvanizing and ductility.

Crapo Galvanized Strand is readily available in all standard grades and sizes. Ask your Jobber, or write direct for technical details!

INDIANA STEEL & WIRE CO.
MUNCIE, INDIANA

Factors Affecting 1938 Electric Manufacturing Business

[*Continued from page 110*]

for adequate wiring which, when made known to the public, will develop a force that should give the electrical industry the greatest impetus it has ever received, enabling it to face the future with the confident assurance that this industry will grow and prosper in proportion as it serves a useful purpose.

While in the past constructive programs such as this have been blocked by antagonists and actions of willful minorities who have heretofore found it difficult to recede from positions previously announced, it now seems clear that these obstacles will be laid aside in favor of wholly constructive proposals behind which all branches of the electrical industry can unite and which will merit and receive full public support.

Jackson's Political Status

[*Continued from page 111*]

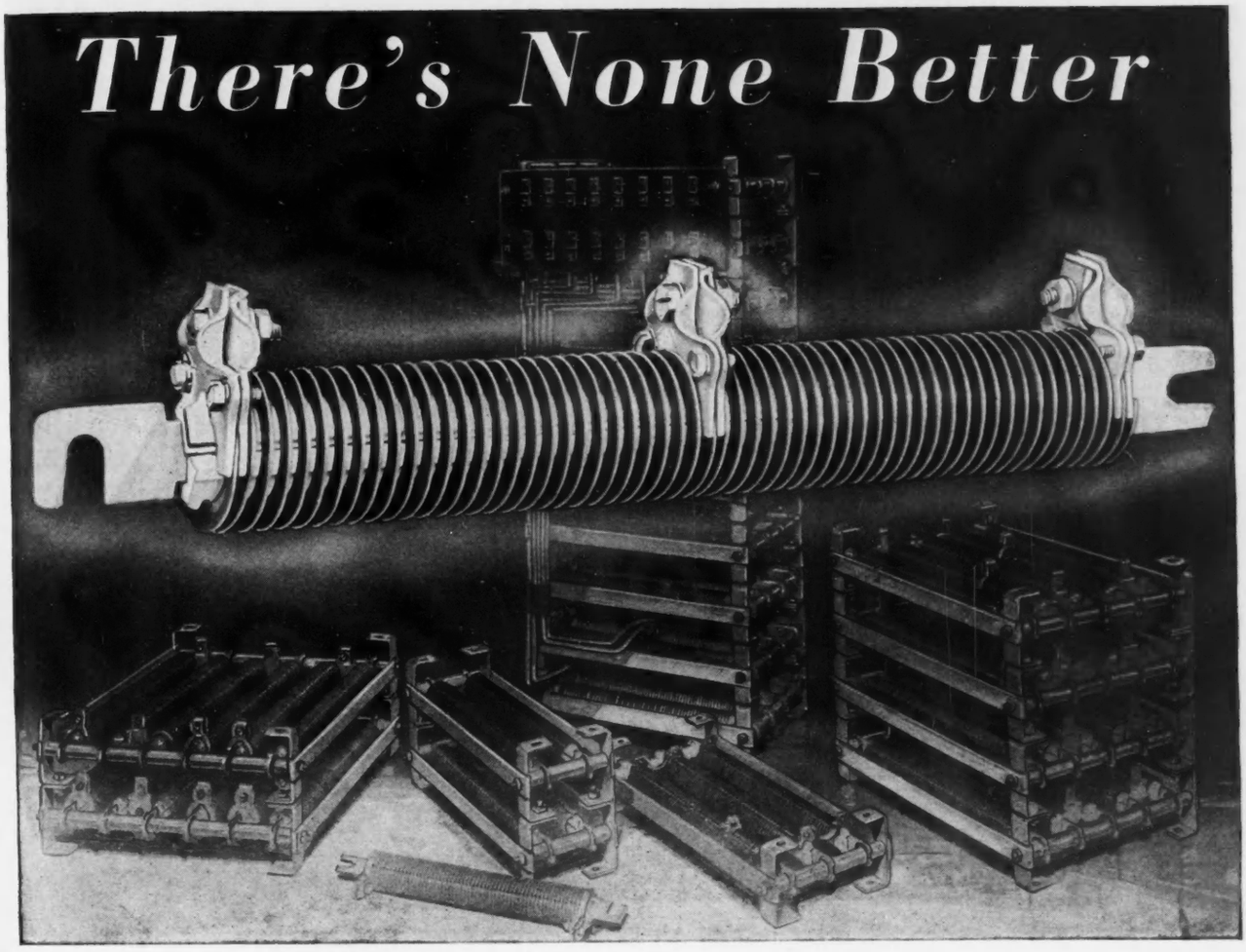
him. This just may develop, though at present the pessimism about it among Republicans from New York seems rather pronounced.

But it's apt to be a fight tremendously worth watching. A defeat of Jackson, with Roosevelt behind him, might inspire the Republican party nationally. Failing that, it might aid the Southern conservatives mightily in their fight to prevent the nomination of a New Dealer by the Democratic party in 1940.

Meanwhile the Supreme Court disappears as a bulwark against government infiltration in business, leaving Congress—those same Southern conservatives as a matter of fact—as the last line of defense. Powerless to regain lost ground, but forceful in resisting further advances.

With the resignation of Justice Sutherland, and the sure appointment of a New Dealer in his place, there remain only two conservatives on the high bench. Both of these, Justices McReynolds and Pierce Butler, have wanted to resign for a long time. They have held off, hoping. Their fight is lost. Their further participation is futile. Friends say both will probably retire at the end of the present term.

There's None Better



Monitor

Monitor builds resistors for every class of service—"Smooth-wound" for low currents, "Hex-wound" for intermediate currents, "Edgewound" for heavy currents.

Special mountings are available for application where standard mountings are not entirely suitable; quotations on same will be furnished on receipt of full information concerning the requirements. . . . Monitor sales engineers in principal cities will gladly consult with you. Write us.

WHEN better resistors can be built, Monitor will build them. . . The acknowledged merit of Monitor resistors is manifested by their unprecedented popularity. For over ten years these resistors have proven their superiority by uninterrupted service.

Edgewound Resistors, a development of Monitor engineers, provide the maximum of heat dissipation and current carrying capacity with minimum weight. The flexibility of assembly is unequalled; any number of units can be arranged in a bank with permanent or adjustable connection terminals. Capacities for high or low currents make them suitable for any application.

These resistors will operate at high temperatures, and by virtue of their construction, are practically indestructible. Their light weight, flexibility, and dependability are reasons for their being specified or demanded by most engineers.

(Write for Bulletin No. 111)

Monitor Controller Company

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STEEL TOWER • • • WOOD POLE LINE CONSTRUCTION
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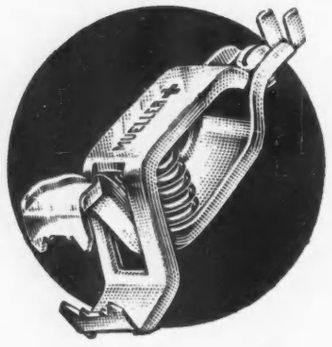
Highly experienced personnel—modern equipment for modern construction. Schulman Erection Specialists are immediately available for the most extensive projects and cooperate fully with you through every step of the way. They have the ability to erect lines in the quickest time and at the lowest possible cost to you.

Recent Projects Completed

Wilson-Norris Steel Tower Line—121 miles, Tennessee
Wheeler-Guntersville Steel Tower Line—65 miles, Alabama
Fort Peck Dredge Feeder Distribution System—Fort Peck, Montana

Now under construction

Skagit Steel Tower Transmission Line—116 miles, Washington State



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REA Allotments Made; New Contracts Let

Among the allotments announced by the Rural Electrification Administration during the month of November were the following:

ARKANSAS—Co-operative being formed, partial allotment $200,000, out of $297,000 requested, 286 miles of line, 1,009 customers. Carroll and Benton counties. Source of power will probably be Arkansas Power & Light Company.

KANSAS—Co-operative being formed, allotment $222,000, to build 221 miles of line, 520 customers, Sedgwick County. Source of power will probably be Wellington municipal plant. Co-operative being formed, allotment $160,000, to build 151 miles of line, 386 customers, Doniphan County. Source of power will probably be Kansas Power & Light Company.

OHIO—Co-operative being formed, contingent approval of partial allotment of $100,000, out of $522,000 requested, 515 miles of line, 1,775 customers, Paulding, Putnam and Defiance counties. Contingent upon the co-operative securing a satisfactory source of power.

TEXAS—Co-operative being formed, partial allotment $100,000, out of $513,000 requested, 478 miles of line, 1,488 customers, Navarro and Hill counties. Source of power will probably be Texas Power & Light Company. Coleman County Rural Electric Co-operative (to be formed), partial allotment $100,000, out of $387,000 requested, 412 miles of line, 850 customers, Coleman, Brown and Callahan counties. Source of power will probably be Coleman municipal plant. Co-operative being formed, partial allotment $100,000, out of $188,000 requested, 201 miles of line, 568 customers, Lubbock County. Source of power will probably be Texas-New Mexico Utilities Company.

IOWA—Buena Vista County Rural Electric Co-operative, partial, additional allotment $100,000, out of $325,000 requested, 317 miles of line, 886 customers, Buena Vista County. Served by Central Electric Federated Co-operative Association, an REA-financed generating plant. Butler County Rural Electric Co-operative, partial, additional allotment $105,000, out of $210,000 requested, 235 miles of line, 613 customers, Butler and Hardin counties. Served by Federated Co-operative Power Association, an REA-financed generating plant. Wright County Rural Electric Co-operative, partial, additional allotment $100,000, out of $340,000 requested, 340 miles of line, 981 customers, Wright County. Served by Federated Co-operative Power Association. Pocahontas County Rural Electric Co-operative, partial, additional allotment $103,000, out of $198,000 requested, 220 miles of line, 600 customers, Pocahontas and Buena Vista counties. Served by Central Electric Federated Co-operative Association.

OKLAHOMA—Southwest Rural Electric Co-operative, partial allotment $150,000, out of $312,000 requested, 323 miles of line, 889 signed customers and an additional 222 potential customers, Tillman, Jackson and Kiowa counties. Source of power will probably be Altus municipal plant.

Construction Contracts

ARKANSAS—Farmers Electric Co-operative Corporation, Newport, to Cater Construction

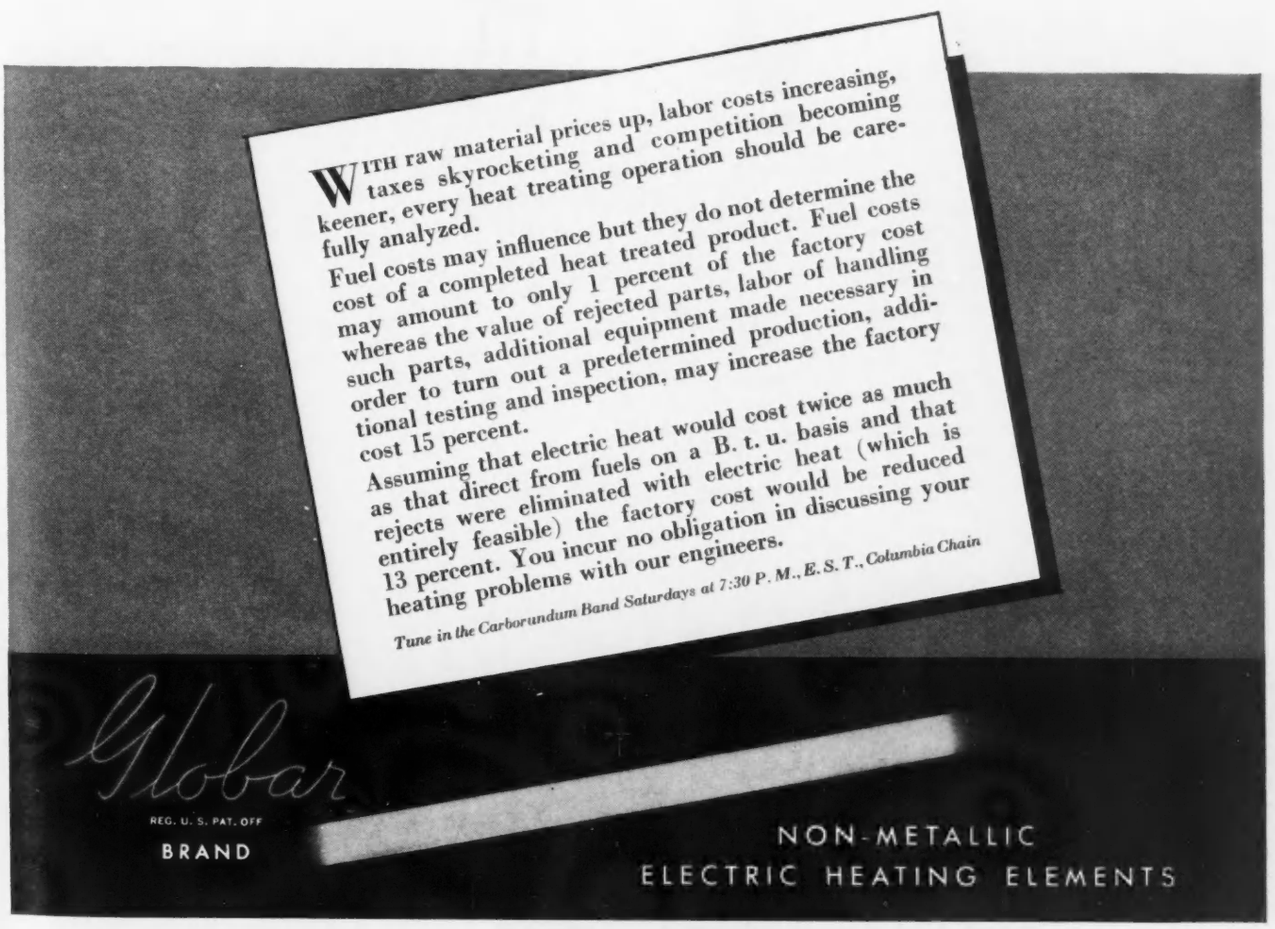
INVESTIGATE

Globar

REG. U. S. PAT. OFF.

AND

ELECTRIC HEAT


WITH raw material prices up, labor costs increasing, taxes skyrocketing and competition becoming keener, every heat treating operation should be carefully analyzed.
Fuel costs may influence but they do not determine the cost of a completed heat treated product. Fuel costs may amount to only 1 percent of the factory cost whereas the value of rejected parts, labor of handling such parts, additional equipment made necessary in order to turn out a predetermined production, additional testing and inspection, may increase the factory cost 15 percent.
Assuming that electric heat would cost twice as much as that direct from fuels on a B. t. u. basis and that rejects were eliminated with electric heat (which is entirely feasible) the factory cost would be reduced 13 percent. You incur no obligation in discussing your heating problems with our engineers.
Tune in the Carborundum Band Saturdays at 7:30 P. M., E. S. T., Columbia Chain
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Here is the only pruner with the famous Seymour Smith "Center Cut" construction; safety catch to lock blade closed; one piece tempered tool steel blade; reinforced hook; extra long life spring; ball bearing pulley; highest quality chain; unbreakable iron head.
Designed by experts for experts; demanded by public utility companies everywhere, it will pay you to write for literature and prices.
SEYMOUR SMITH & SON, Inc.
111 Main Street
OAKVILLE, CONNECTICUT

Company, Inc., Kansas City, Mo., 268 miles of line, the entire project. Low bid $188,228.

TEXAS—Farmers Electric Co-operative, Inc., Greenville, to J. E. Morgan & Sons, El Paso, 594 miles of line, the entire project. Low bid $396,692.

IOWA—Calhoun County Rural Electric Co-operative Association, Rockwell City, to Duplex Manufacturing Company, Omaha, Neb., second section of project, 121 miles, 270 customers. Low bid $111,014. Eastern Iowa Light & Power Co-operative, Davenport, to Monroe Electric Company, Chicago, Ill., for building another section of project, 93 miles of line, 287 customers. Low bid $100,908. Monona County Rural Electric Co-operative, Onawa, to Duplex Manufacturing Company, Omaha, for building entire project, 244 miles of line. Low bid $175,897. Grundy County Rural Electric Co-operative, Grundy Center, to Porter-De-Witt Construction Company, Kirkwood, Mo., for building the second section of the project. Low bid $97,405.

KENTUCKY—Union County Rural Electric Co-operative Corporation, Morganfield, to Henry Bickel Company, Louisville, 185 miles. Low bid $133,679.

OKLAHOMA—Red River Valley Rural Electric Company, Thackerville, Okla., to P. E. Workman, Dallas, Tex., for building entire project—150 miles. Low bid $127,609.

ILLINOIS—Eastern Illinois Power Co-operative, Watseka, to A. S. Schulman Electric Company, Chicago, Ill., for building the first 700 miles of project, 1,870 customers. Low bid $555,906.

INDIANA—Jay County Rural Electric Membership Corporation, Portland, Ind., to Haines & Haines Construction Company, Dowagiac, Mich., for building entire project—141 miles. Low bid $111,788.

MICHIGAN—Thumb Electric Co-operative of Michigan, Ubly, Mich., to Fairbanks Morse & Company, Beloit, Wis., for supplying the three 1,000-hp. Diesel-powered generating units to be used in this project. Low bid $187,500.

COLORADO—Bent-Prowers Rural Power Lines Association, Lamar, to Chapin Contracting Company, Wichita, Kan., for building entire project—162 miles. Low bid $112,547.

•

"Thinking Boxes" Control Piccadilly Circus Traffic

Three "thinking boxes" have recently been installed in and around Piccadilly Circus to handle traffic; they do the work of about twenty point-duty policemen, according to the U. S. Bureau of Commerce.

Piccadilly Circus has six traffic arteries leading into it and two intersections only a few yards away. The volume of traffic passing every point must be measured and the lengths of the green and red signals adjusted accordingly, since it is not enough for traffic to operate the rubber pads changing the lights.

Function of these boxes is to measure density of traffic at each point by

UP-TO-THE-MINUTE TESTING FACILITIES

guard the quality of ROEBLING Power Cable!

SHOWN is the Roebling Test Transformer Panel for producing stresses up to 400,000 volts, for high tension testing in the Power Cable Department. Similar equipment is available for lower voltage testing of varnished cambric and rubber insulated cables.

The Roebling Varnished Cambric Power Cable shown below is available in single, two and three conductor types; for a wide range of voltages; in all commercial sizes, with braided finish or lead sheath.

Metallic coverings of zinc, bronze, plain or galvanized steel tape or round wire armor of copper or galvanized steel wire can be supplied to these or other types of Roebling cables.

To meet power station, industrial, building, and other needs, Roebling offers over 60 types of high quality electrical wires and cables.

JOHN A. ROEBLING'S SONS COMPANY
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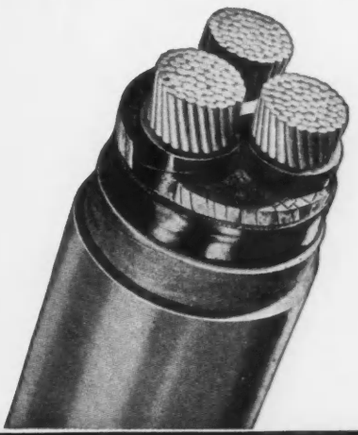

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For long life and economy in annual maintenance costs, Everstick Anchors are first choice in rural electrification construction. Their safety and dependability have been proven on millions of miles of electric lines.

ANCHORS FOR EVERY PURPOSE

The complete line of Everstick Anchors offers three expanding types in a complete range of sizes and holding capacities. Also rigid type Cone Anchors in all sizes. Made of malleable iron with its properties of strength, elasticity and rust resistance. Write for new bulletin "Everstick For Rural Electrification."

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THE EVERSTICK ANCHOR CO. Fairfield, Iowa

"HANG THE LOAD ON HUBBARD HARDWARE"

"HANG THE LOAD ON HUBBARD HARDWARE"

measuring the length of the gaps between vehicles, rather than by counting number of vehicles. When gaps are long a signal is passed automatically to the box which cuts down the green time at that point. If traffic is especially heavy at another point additional time is allotted to it and adjustments automatically made at every other control point.

•

Power Plan Adopted by Japanese Cabinet

The Nagai power plan, which provides for state control of the Japanese power industry, has been adopted by the Cabinet for drafting and submission to the Diet as soon as possible. It is reported that there was strong opposition to the plan.

It contemplates the appointment of a commission to select and appraise the nation's principal generation, transmission and equipment companies for subscription to capital of a special company. The government will name officials for the new company and will decide upon charter changes, debenture issues, disposal of profits and issue and supervision of orders. Local distribution companies and some hydro plants are apparently to be left in private hands.

One feature of the plans calls for the withholding of power from "enterprises deemed uneconomic." According to Mr. Nagai, it will reflect state policies with regard to power charges and give preferential rates to industries devoted to the national defense.

•

Diagram Method of Locating Faults in Submarine Cables

In a recent issue of the Japanese journal *Nippon Electrical Communication Engineering* Aikichi Susuki describes a method of locating faults in submarine cables by means of diagrams. Principle of the method is that of measuring the apparent impedance of the faulty cable, the distance where the fault lies being determined by plotting the measured impedance on a diagram representing the law of impedance variation of cables in which resistances are inserted at various points in lengths ranging between zero and infinity.

After describing the technical aspects of the method, the author

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by ARTHUR L. ABBOTT

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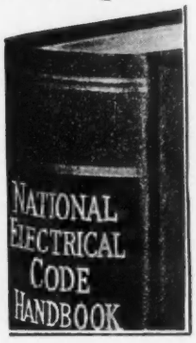

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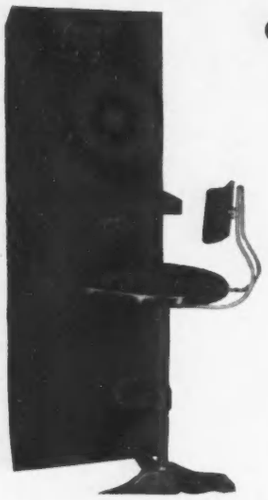

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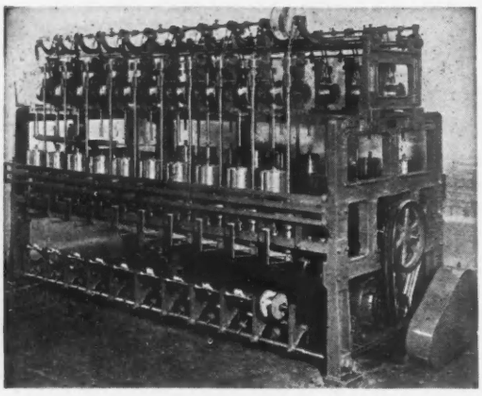

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describes conditions under which the measurements should be carried out to secure an acceptable degree of accuracy, currents of different frequencies being necessary according to distance of fault in cable.

•

1937 Canadian Hydro Total Is 167,161 Hp.

New water-power installations in Canada in 1937 amounted to 167,161 hp., bringing the total for the Dominion to 8,112,571 hp. at the end of last year, according to T. A. Crerar, Minister of Mines and Resources.

Larger new developments of the year were those of Ontario Paper Company on the Outardes River in Quebec, where an installation of 70,000 hp. was completed, and the Great Lakes Power Company, which brought into operation a 10,000-hp. installation on the Montreal River in Ontario. Remainder of increase was made up for the most part by extensions to existing stations. The increase by provinces: British Columbia, 1,050 hp.; Saskatchewan, 19,000 hp.; Manitoba, 12,500 hp.; Ontario, 15,475 hp.; Quebec, 116,366-hp.; Nova Scotia, 2,770 hp.

Outstanding among projected developments are: Project of the West Kootenay Power and Light Company at Brilliant on the Kootenay River, where the development of 90,000 hp. is contemplated under a head of 90 ft.; addition of a second unit of 47,000 hp. to the Ruskin power station of the British Columbia Power Corporation on the Stave River; Shawinigan Water & Power Company's project at La Tuque, on the St. Maurice River. which will have an initial installed capacity of 162,000 hp.

•

Vast Water Power Reserves Found in British Columbia

Engineers of the provincial department of lands have discovered one of the world's greatest potential water power reserves on the British Columbia coast. After years of study experts of the department have announced that they have found a feasible method of turning the great Nechako watershed so that it will run westward to the sea on Dean Channel.

The Nechako, rising in a circle of large lakes, runs eastward into the

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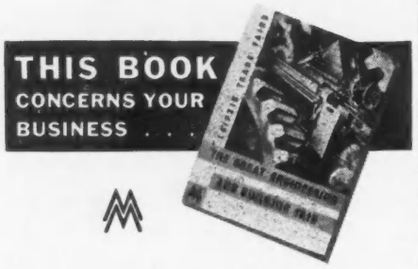

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EDITOR: "I have checked my own impressions with those of other American engineers who have been at the Fair at different times, and I am confident that the Technical Fair is one of the most important events of its kind in the world, if not the most important."

EXECUTIVE: "It seems to me very important that American firms take advantage of the opportunity offered by this Leipzig Fair in order to become better acquainted with what is being done abroad."

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Fraser River near Prince George. If it were diverted westward through the Coast Mountains it would develop 1,000,000 hp. in electricity, government engineers reported. This is almost twice the total amount of electricity now being developed and used in British Columbia.

•

Safe Harbor Hydro Cost Reset by FPC

Actual legitimate original cost of the Safe Harbor Water Power Corporation's 255,000-hp. hydro-electric project on the Susquehanna River has been set in a recent opinion of the Federal Power Commission at $24,839,091, as of December 31, 1932. Additional claimed cost of $73,894 was reserved for further opinion.

In a previous opinion, delivered in 1935, the commission allowed $24,606,825, reserving further decision on items totaling $567,587. Licensee petitioned for a rehearing, which began in March, 1936.

Under an agreement at present under investigation by the FPC, the entire output and capacity of the hydro plant is sold to the Consolidated Gas, Electric Light & Power Company of Baltimore and the Pennsylvania Water & Power Company, which jointly control the licensee.

The agreement provides, in part, that beginning January 1, 1938, payments to Safe Harbor by the controlling companies are to be of such amount as is required to yield Safe Harbor a net income of 7 per cent on its initial six-unit development, averaged for the year in question, after all reasonable operating expenses have been taken into consideration. These payments are to be made regardless of the amount of power furnished either of the controlling companies.

•

EHFA Signs New Contracts

Contracts for the financing of electrical appliances have been closed by the Electric Home and Farm Authority with the town of Farmville, N. C., Northwest Missouri Electric Co-operative, Savannah, Mo., and the Dakota County Electric Co-operative, Farmington, Minn. Contracts have also recently been signed with Lexington, N. C.; Kinston, N. C.; Fayetteville, N. C.;

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For applications where heat resistance is of primary importance we have developed a special type of Varnished Cambric Cable which is even more resistant to continuous high temperatures than the standard type. Inquire about our "high-temperature" varnished cambric.

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The Never Creep is the only anchor on the market that pulls entirely against solid undisturbed earth. No area is wasted and there is no danger of slipping or creeping.

It is superior in principle, in construction, in ease of handling, in ease of installation and in final results obtained. There are only two pieces to handle, no frail parts to come loose or break, and the installation involves only three simple operations—drive the rod, bore the hole and hang on the plate.

It is easily retrieved and may be used for temporary guying. As a permanent guy it is one anchor that can be depended on for real permanency.

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Back-Breaking Methods are OUT!

Above is the Greenlee Rigid Conduit Bender in use. It is made in two sizes for conduit from 1¼ to 3-inch and from 2¼ to 4½-inch. The small bender can be fitted with special attachments for bending thin-wall steel conduit in 1¼, 1½ and 2-inch sizes.

It is easy to bend Conduit and Pipe with a Greenlee, and it Saves Time and Money, too!

If everyone knew about the advantages of bending with the Greenlee Hydraulic Conduit and Pipe Bender, there wouldn't be much time wasted with old-fashioned, back-breaking methods. And there would be more conduit installed where the bends are smooth and even, not to mention the time that would be saved in making them.

Here is a portable tool that is simple and easy to operate, yet it bends conduit quickly, making smooth even bends on any size within its range. Hydraulic pressure, set up by pumping the handle, does the bending. And its operation is just as simple as the picture indicates.

Complete information on Greenlee Conduit and Pipe Benders will be sent gladly. Tell us what you want to bend.

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Board of Light and Water Commissioners of the City of Concord, N. C.; Camilla, Ga., and the Missouri Rural Electric Co-operative Association, Palmyra, Mo.

•

Westinghouse Speeds Work on Floodgates

Work is progressing rapidly on the new $550,000 floodgates which will protect the Turtle Creek Valley, home of Westinghouse Electric & Manufacturing Company, from future high waters of the neighboring Monongahela River.

In the event of flood two gates will be dropped at East Pittsburgh to form a barrier protecting the valley—one across the river and one across the roadway. The steel gate which will close the roadway is 40 feet long and 20 feet high and when not in use will be held 20 feet above the street level to accommodate traffic. The gate which will dam the creek will be 80 feet long and 30 feet high.

Three vertical type pumps, having a combined capacity of from 5,000 to 7,500 cu.ft. per second, depending on the stage of the water, will handle the flow of Turtle Creek. These pumps will be powered by 4,500-hp. electric motors, each 23 feet in diameter. The Duquesne Light Company will supply the power. The first pump will be tested late in January.

•

New Lamps for Bridge Artery

Public Service Electric & Gas Company is to install 174 lamps of 400 cp. at 400-ft. intervals along the 12-mile stretch of Route 4, forming the principal artery from Paterson, N. J., to the George Washington Bridge. The installation is an experimental lighting project announced by the State Highway Department in an attempt to reduce fatalities on this stretch of road, known locally as "Death Highway" because of its high accident rate.

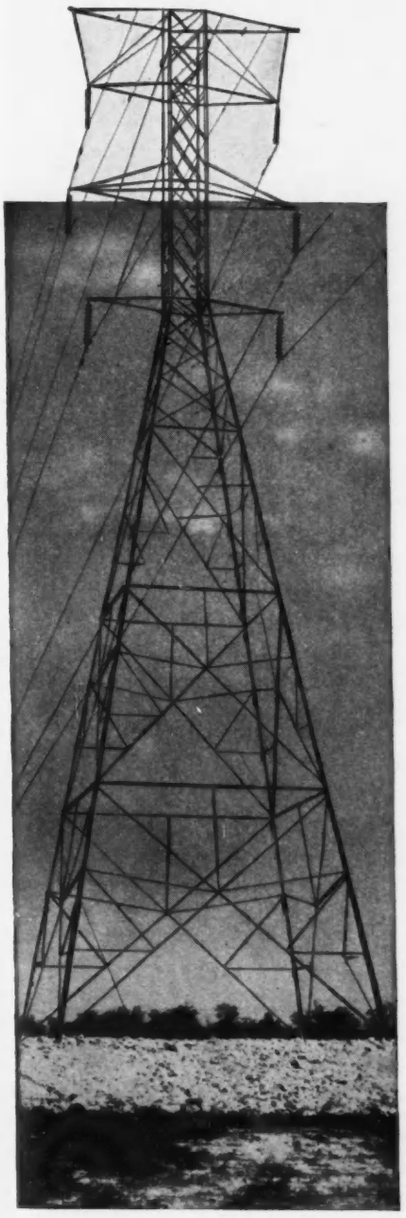
•

Rural Progress in Quebec

Substantial progress was achieved in 1937 in the electrification of rural districts in the Province of Quebec. It is reported that some 450 miles of transmission lines have been built during the year, involving an investment

Switch your Power Load to

AMERICAN BRIDGE TOWERS



These illustrations show a well-designed river crossing unit (left tower, suspension type, 128 ft. high; right, strain type, 93 ft. high) carrying 6 conductors and 2 ground wires for a 154 k.v., two single circuit electric transmission line.

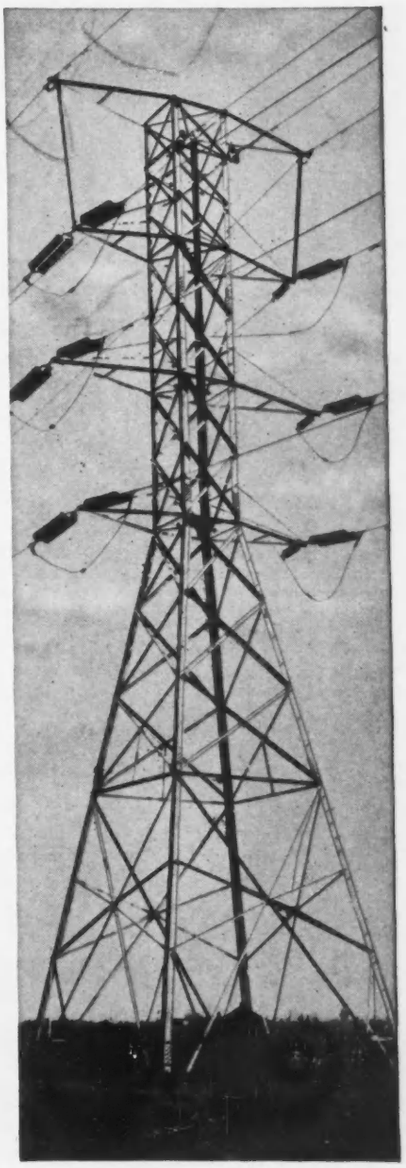
STEEL transmission towers were new, different, practically untried in 1905 when American Bridge Company engineers built their first for the line from Gainesville, Ga. to Atlanta. Thousands of experimental dollars were at stake.

But they were built with confidence! Each step had been carefully worked out, thoroughly pre-tested by these engineers. They knew, with reasonable certainty, that permanently lowered maintenance costs and improved continuity of electrical service would result.

That was 32 years ago! Today, American Bridge Engineers draw upon a remarkable background of experience. They have constructed towers for every character of terrain, weather and service. They have developed many patented features, largely responsible for a more effective, more economical construction of America's power network.

Many electrical engineers have made full size tower tests at American Bridge's proving grounds under loading technique duplicating field conditions. Most electrical engineers have watched American Bridge Towers withstand the tests of 10, 20 and even 30 years of service.

Switch your power load to American Bridge Towers. The same staff responsible for the efficient, economical construction of many of today's major transmission line projects, backed by the entire resources of American Bridge, is available to you for any tower project, under any conditions, at any place and at any time.



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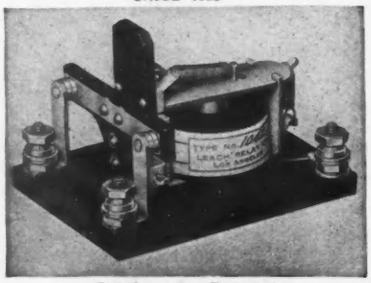

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of approximately $750,000. Principal activity has been in the areas served by Shawinigan Water & Power Company.

•

Lighting Modernized at Harvester Office

A totally indirect, 44-ft.-candle intensity lighting system and air conditioning form part of the recent $750,000 modernization of fifteen floors of the International Harvester Company's headquarters in Chicago.

Present capacity of the new system, which was changed from d.c. to a.c., is said to be 10 watts per sq.ft. of floor area or 80,000 watts for each one of the floors. Since the connected lighting load is only 5 watts per sq.ft., it is said that twice the present load can be carried without a wiring alteration, thus preparing for changes in present standards of adequate lighting.

Open-bay lighting requirements were met with a totally indirect Curtis pendant fixture hung on 8-ft. 6-in. centers at 30-in. suspension. Each unit is equipped with a silver-mirrored "X-ray" reflector designed to use a 300- or a 500-watt Mazda lamp, or a 1,000-watt bipost lamp. With a 500-watt lamp 44-foot-candles is obtained. Where the air conditioning ducts decrease the ceiling height to 7 ft. 8 in. short projections units, designed for illumination of low-ceilinged areas, were employed.

The company estimates that air conditioning costs 1 cent per hour for each of the 1,000 employees; lighting, ½ cent per hour per person.

•

Hanson-Van Winkle-Munning Adds Office and Shop Space

As a result of the steadily increasing activity in the electroplating industry Hanson-Van Winkle-Munning Company, Matawan, N. J., has undertaken a considerable expansion program.

A new office building adds 2,000 sq.ft. of space and is used as a drafting and engineering room. The second extension within two years has been made to the electrical shop and, with the first extension adds some 6,000 sq.ft. of space. A new railroad spur has been built with sunken tracks so car floor is on level with new concrete

loading platform, a 60-ton crane has been erected for loading and unloading heavy equipment and a new electrical substation has been added to take care of the additional load.

•

London Borough Gets Mercury-Vapor Lamps

With the relighting of every street (more than 50 miles) by means of high-pressure mercury-vapor discharge lamps, the borough of Deptford becomes the first London district to be lighted entirely in this manner.

Approximately 2,000 lamps are in process of being installed. These comprise 1,032 80-watt lamps for 26 miles of streets, 565 125-watt lamps for 14 miles, 225 250-watt types for 6 miles of through traffic routes and 172 400-watt units for 4 miles of main highways. Spacing of the units averages 150 ft., being modified where necessary to secure high lighting efficiency at road curves, junctions and intersections.

The mounting heights are 25 ft. in the main thoroughfares and through traffic routes and 18 ft. the secondary and residential roads. The columns, which have been specially designed for Deptford, are of spun concrete.

•

Steady Work for Employees

Fred Haug, field agent for the United Electrical, Radio and Machine Workers of America, stated recently that officials of the Westinghouse Electric & Manufacturing Company had assured the union that veteran employees of the company would have steady work despite a recession in orders. Company officials declined comment.

•

Nicaraguan Towns Buy Utilities

A number of municipalities in Nicaragua are reported as buying public utilities, electric light plants and water works because of the failure of private enterprise to enlarge their plants to meet demands of the public. General feeling is said to be against municipal ownership, yet the public believes it gets better service at cheaper rates this way.

MEMCO

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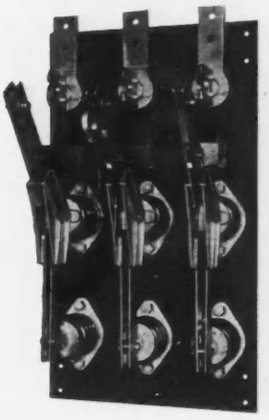

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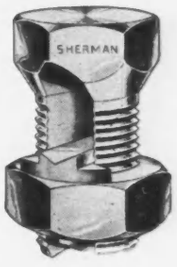

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BOOK REVIEWS

Elementary Theory of Operational Mathematics

By Eugene Stephens. Published by McGraw-Hill Book Company, 330 West 42d Street, New York, N. Y. 313 pages. Price, $3.50.

Use of the operator has been far more general in electrical engineering than elsewhere, but even there the technique still was stratified in the rarefied Heaviside layer of most electrical mathematicians. The author brings the mechanism down to mundane reality and simplicity. The calculus grew out of and outgrew algebra, but here all integration is inverted and resubjected to familiar algebraic transformations and manipulations—after the preliminary passages no integral signs are employed.

This is classifiable as an advanced college text, but any circuit-analysis engineer who shies from integration and differential equations will surely relish the nicety and economy with which Professor Stephens has paved the way for a new calculus pedagogy by emphasizing basic reliance upon algebraic mechanism applied to D (in both its direct and reciprocal aspects).

A noteworthy bibliography confirms the fact that operational mathematics is a century old and that the renascence of the last three decades is attributable largely to the erudite revival by Heaviside.

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Réseaux Electriques Maillés

(*Meshed Networks*)

By Ch. Lavanchy. Published by Dunod, 92, Rue Bonaparte (VI) Paris. 134 pages, 51 diagrams. Price, bound, 34 francs.

The full title is "General Method for Computing Meshed Electric Networks." The author gives a systematic presentation of a procedure devised by him for calculating meshed networks and describes its application for various conditions. The purpose of this method, algebraic in form, is to simplify the computation to a series of steps or transformations applicable to any configuration whatever, and to relieve the user of much of the labor required with other methods. The first two sections develop the theory; the third is devoted to a series of illustrative numerical examples in d.c. and a.c. networks, fully worked out.

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By Glenn Gardiner. Published by Elliott Service Company, 219 East 44th Street, New York, N. Y. 52 pages. Price $0.60.

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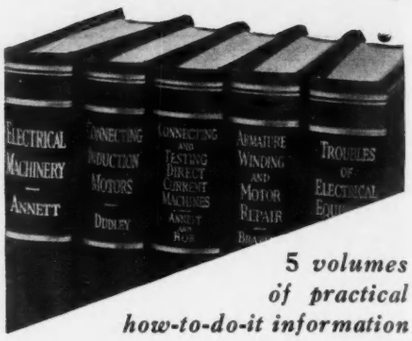

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